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^aPrinted in scientific and technical publications outside the Department.

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No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Organic agricultural chemistry, J. S. CHAMBERLAIN (*New York: The Macmillan Co., 1916, pp. XVII+819*).—This volume is divided into three sections: (1) Systematic, which includes the study of the composition, constitution, character, and relationship of the more important organic compounds occurring in plants and animals; (2) physiological, which embraces a study of the chemical reactions involved in the fundamental processes of living organisms, in the utilization of food by animals, and in photosynthesis in plants; and (3) crops, foods, and feeding, which includes the study of the distribution of food constituents in agricultural crops and the principles of animal foods and feeding. The presentation of the subject matter is general and of such a nature as to follow a course in general chemistry.

An introduction to the physics and chemistry of colloids, E. HATSCHEK (*Philadelphia: P. Blakiston's Son & Co., 1916, 2. ed., pp. IX+107, figs. 17*).—This is the second edition of a volume, the subject matter of which has been essentially noted (*E. S. R.*, 29, p. 608). The only substantial addition to the text of the first edition is an appendix on experimental technique.

Studies on plant colloids, II-VI, M. SAMEC ET AL. (*Kolloidchem. Beihefte*, 4 (1912), No. 3-5, pp. 132-174, figs. 13; 5 (1913), No. 5, pp. 141-210, figs. 31; 6 (1914), No. 1, pp. 23-54, figs. 12; 7 (1915), No. 6-12, pp. 137-171, figs. 9; 8 (1916), No. 1-2, pp. 33-62, figs. 7).—Five papers are presented.

II. The stability of starch solutions, M. Samec.—Continuing the study previously noted (*E. S. R.*, 30, p. 111) it is shown that the viscosity of a starch solution decreases appreciably with time. The final viscosity of a 1 per cent starch solution lies within the limits of the viscosity of molecular disperse systems. This decrease in viscosity is greater in dilute than in concentrated solutions. Hydrochloric acid retards the initial viscosity of starch solutions, but later prevents a decrease (stabilizer). Alkalis in the lowest concentration increase the viscosity of starch solutions and in higher concentrations coagulate them. Of the neutral salts ammonium sulphate and ammonium thiocyanate also decrease the internal molecular friction of the starch particles. The sensitiveness to the action of electrolytes decreases with increasing age of the starch solution. With a decrease of internal friction the electrical conductivity increases.

The removal of the ash, the action of electrolytes, and also the change in the behavior of starch in the electrical field can be explained as due to the presence of an ionized starch-phosphoric-acid complex.

III. *Changes in starch by removal of the ash and solution*, M. Samec and F. von Hoeft.—The three processes of removing the ash, solution, and agitating produce the same changes in the properties of starch, viz, a decrease in the internal friction and in the influence of acids and bases on the latter. The rapidity of the changes is proportional to the temperature. Simultaneously with a decrease in viscosity there is an increase in the electrical conductivity and a decrease in the amount of starch precipitable by alcohol. The osmotic pressure is only slightly lowered, while the optical rotation is slightly increased. The titratable acid is also increased. At ordinary temperatures only small amounts of electrolyte can be extracted from the starch by water, but as the starch grains swell the amount extracted increases. It is indicated that the above observations and many others made by earlier investigators can be explained by the presence of an amylophosphoric acid.

IV. *The displacement of the phosphoric acid content by a change of condition of the starch and by diastatic cleavage*, M. Samec.—From starch grains which had been treated with potassium hydroxide a fraction containing phosphorus and a phosphorus-free fraction were isolated. By the diastatic cleavage phosphorus-containing dextrans which possessed all the properties of electro-negative colloids were obtained. On boiling with water these dextrans were destroyed and phosphoric acid was set free.

V. *On soluble starch*, M. Samec and S. Jencic.—Starch, in being converted to the soluble form, was essentially changed in structure. In most instances a contraction of the starch particles was apparent, while in exceptional cases there was no alteration. Most soluble starches contain phosphorus, but not those prepared according to the procedure of Malfitano and Moschkoff^a and those prepared by heating in glycerin. On account of the variations in the physicochemical characteristics of the so-called soluble starch the term is considered scientifically inadequate. The experimental procedures used in the investigation are described in detail.

VI. *On alkali starch*, M. Samec.—By the action of alkalis on starch a number of different modifications could be demonstrated. The formation of two of these was attributed to the action of the alkali with the phosphoric acid of the starch (amylophosphate). By the continued action of the alkalis they are also bound at other points in the starch molecule, forming amylores. These substances finally cause a cleavage of the starch complex.

Crystalline β -methyl fructosid and its tetracetate, C. S. HUDSON and D. H. BRAUNS (*Jour. Amer. Chem. Soc.*, 38 (1916), No. 6, pp. 1216-1223).

A fourth crystalline pentacetate of galactose and some related compounds, C. S. HUDSON and J. M. JOHNSON (*Jour. Amer. Chem. Soc.*, 38 (1916), No. 6, pp. 1223-1228).

The determination of phosphoric acid by the uranylacetate method, D. CRISPO and R. W. TUINZING (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwprefat.* [Netherlands], No. 17 (1915), pp. 142-156; *Landw. Vers. Stat.* 83 (1916), No. 1-2, pp. 131-141).—A modified procedure for the uranylacetate method for the determination of phosphoric acid is described in detail. The phosphoric acid is first precipitated as ammonium-magnesium phosphate, the precipitate dissolved in acetic acid, and the solution then titrated with the standard uranium solution. The method is applicable to the determination of the various forms of phosphoric acid present in fertilizers without the usual inherent difficulties. Experimental data submitted, comparing the proposed procedure with the official methods of Lorenz and Pemberton. ¹⁰³

^a *Compt. Rend. Acad. Sci. [Paris]*, 150 (1910), No. 11, pp. 710, 711; 151 (1910), No. 19, pp. 817-819.

cate its accuracy. The uranyl oxid can be easily recovered from the phosphate precipitate.

On the solubility of phosphoric acid in Thomas slag by extraction with water containing carbon dioxide, J. G. MASCHHAUPT (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 17 (1915), pp. 37-141, figs. 5*).—Analytical data indicating the amount of phosphoric acid of Thomas slag soluble in water containing carbon dioxide, with various amounts of calcium oxid and silicate present in the slag, are submitted in detail. The data are discussed and the value of such a procedure for determining the available phosphoric acid in slag fertilizers is emphasized.

Experiments on the extraction of potash from wyomingite, R. C. WELLS (*U. S. Geol. Survey, Prof. Paper No. 98-D (1916), pp. 37-40*).—This paper records experimental data on the chemical and mineral composition of wyomingite (a lava occurring extensively in the Leucite Hills in Sweetwater County, Wyo.), its behavior in water, and the effect of heating with gypsum, sulphuric acid, potassium bisulphate, alunite, calcium carbonate, calcium chloride, magnesium chloride, a bittern, and ammonium sulphate. The percentage of the total potash extracted by heating with the various materials ranged from 16.2 to 57, the largest amount being obtained by heating with alunite.

It is indicated that while the experiments described can not all be considered as commercial possibilities they may be suggestive to other investigators and save the repetition of considerable preliminary investigation.

A new apparatus for the determination of soil carbonates and new methods for the determination of soil acidity, E. TAVOC (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 341-345, figs. 2*).—A new form of apparatus, using the absorption tower previously noted (*E. S. R., 34, p. 501*), and its manipulation are described in detail.

Experimental evidence indicates that there exist in the soil two kinds of acidity which are designated as active and latent. Methods for their separate determination are proposed. It is further indicated that "soil acidity is due to true acids and not selective ion adsorption by colloids; the avidity of the active acids in different soils varies greatly, which is of prime importance." See also a previous note by the author (*E. S. R., 34, p. 419*).

The analysis of Hawaiian soils, W. T. McGEORGE (*Hawaii Sta. Rpt. 1915, pp. 33-36*).—Slight modifications in the official methods to meet certain peculiarities encountered in Hawaiian soils, notably the high content of iron, aluminum, titanium, and manganese, are presented, together with results secured with four soils as to the influence of the time of digestion upon the solvent properties of hydrochloric acid.

On the determination of small quantities of hydrocyanic acid, M. O. JOHNSON (*Jour. Amer. Chem. Soc., 38 (1916), No. 6, pp. 1230-1235, fig. 1*).—The method described by Francis and Connell (*E. S. R., 30, p. 700*) has been shown to require certain modifications, which the author has embodied in a convenient and accurate procedure for the determination of small quantities of hydrocyanic acid. The potassium thiocyanate is extracted with acetone and then determined colorimetrically by the production of the ferric thiocyanate. Any organic coloring matter which may interfere with the color of the ferric thiocyanate is removed from the solution by extraction with ethyl acetate.

The procedure was evolved in connection with some chemical work on cassava at the Hawaii Experiment Station.

The microscopy of vegetable foods, A. L. WINTON, J. MOELLER, and KATE B. WINTON (*New York: John Wiley & Sons, Inc., 1916, 2. ed., rev. and enl., pp. XIV+701, figs. 635*).—This volume is the second edition of the work previously noted (*E. S. R., 17, p. 1090*) and deals with the microscopy of vegetable foods,

with special reference to the detection of adulterants and the diagnosis of mixtures. The first part is devoted to general considerations, methods, apparatus, reagents, etc., while the succeeding parts are devoted to the microscopy of the individual substances. The subjects considered are cereal products, together with the commonly associated impurities; oil seeds; legumes; nuts; fruit and fruit products; vegetables, such as tubers, roots, fungi, etc.; alkaloidal products and their substitutes; spices and condiments; and commercial starches. The text is fully illustrated and a general bibliography and glossary are included.

Quantitative sublimation and its application in food analysis, MARIUS GÖBERT (*Ann. Falsif.*, 9 (1916), No. 88-89, pp. 96-98, fig. 1).—This article describes a small sublimator which is easily constructed and yields quantitative results. A method for the determination of caffeine in coffee and in tea, using this apparatus, is also described.

Studies on commercial chicory, M. SIKOT and G. JOBERT (*Ann. Falsif.*, 9 (1916), No. 88-89, pp. 48-63).—This article describes commercial chicory products and indicates the regulations adopted by the Congress of Paris in 1909 for the control of the purity of the material. Complete analytical data of a number of genuine samples, together with data of adulterated samples and imitations, are submitted in detail and briefly discussed.

The determination of the constituents of cotton seed and peanuts and their determination in feeding stuffs, J. A. EZENDAM (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands]*, No. 17 (1915), pp. 69-84, pl. 1).—The author describes a microchemical method for the determination of the presence of cotton-seed meal in a mixed feeding stuff and also a procedure for the determination of small amounts of peanut oil cake.

The action of copper solutions on sucrose. Determination of invert sugar in the presence of sucrose, E. SAILLARD (*Compt. Rend. Acad. Sci. [Paris]*, 161 (1915), No. 20, pp. 591-593).—In determining reducing sugars in the presence of sucrose an error is introduced which yields high results. The increased reduction is dependent on the concentration of the sucrose and of the reducing sugars, on the copper solution, and on the manner of heating. Analytical data submitted demonstrate that an increase in the quantity of invert sugar present decreases the amount of reduction of sucrose. When the reducing sugars correspond very nearly to the amount of copper in solution the reduction is practically negligible. The time of heating and the concentration of the solution also affect the amount of reduction of sucrose. The following procedure for the determination of reducing sugars in beets, sirups, sugars, and molasses is proposed:

A normal solution of the material is cleared with lead subacetate, the excess lead removed with sodium carbonate, and the reducing sugars determined in 50 cc. of the clear filtrate by adding 10 cc. of copper solution and 10 cc. of alkaline solution and heating for 22 minutes on the water bath at from 62 to 64° C. The cuprous oxid is then filtered on an Allihn tube and determined according to the Bertrand procedure. The alkaline solution used in the modified procedure is less concentrated than the one generally recommended.

The determination of sucrose in beet molasses (Clerget-Saillard double neutral polarization method), E. SAILLARD (*Rev. Gén. Chim.*, 18 (1915), No. 1, pp. 42-46).—As previously noted (E. S. R., 28, p. 711), the author maintains that the presence of nitrogenous substances (asparagin, aspartic acid, glutamin, glutamic acid, etc.) so influences the plane of rotation as to make the method of Clerget unreliable. A modified procedure which obviates the effect of the nitrogenous substances present by determining the polarization in a neutral solution is described in detail. The effect of various salts on it

sucrose, the invert sugar, and on the nitrogenous substances in the sugar solution was also studied and the results recorded. Analytical data indicate the accuracy of the modified method by the close agreement with results obtained by the usual copper-solution procedure.

A new species of alcohol-forming bacterium isolated from the interior of stalks of sugar cane infested with the cane borer *Diatraea saccharalis*, W. L. OWEN (*Jour. Bact.*, 1 (1916), No. 2, pp. 235-246, pl. 1).—The morphological, cultural, and physiological characteristics of a new species of alcohol-forming bacterium isolated from borer-infested sugar cane, which the author has named *Bacillus saccharalis*, are described in detail. Sucrose, glucose, levulose, mannite, lactose, galactose, raffinose, maltose, and glycerin are all fermented by the organism. From field experiments on the sugar cane it is concluded that "*B. saccharalis* does not induce any marked deterioration of the juice of growing cane, and indeed the apparently negative results which indicated a higher purity in the inoculated canes is well within the range of possible results from the action of the species."

The conservation of potatoes by spontaneous and pure culture inoculation souring, W. VÖLTZ and H. JANTZON (*Landw. Jahrb.*, 48 (1915), No. 4, pp. 433-534).—Two methods for conserving the surplus potato crop, later to be used as stock food, are described in detail.

It has been demonstrated that for raw potatoes only water-tight pits (concrete or mortar lined) are practicable. Under average favorable conditions the total loss of nutrients is never more than from 5 to 10 per cent. In using earth pits for steamed potatoes the loss in nutrients is never more than from 15 to 20 per cent. With water-tight pits this is reduced to from 5 to 10 per cent.

The spontaneous souring process is not recommended for general use on account of the possibility of infection by pathogenic micro-organisms, which would yield a spoiled product unsafe for use as a feed. The pure culture method, using steamed potatoes which are inoculated with *Bacillus cucumeris fermentati*, *B. lactis acidi*, *B. delbrückii*, or mixed cultures of lactic acid bacteria, is easy and practical and yields the most reliable results.

No difficulty was experienced in feeding the product to animals, preliminary data indicating it to be of great value for milch cows.

Analytical data showing the composition of the potatoes before and at various stages in the souring are also submitted.

Report to the Michigan legislature on the feasibility of using the pulp and chicory dryers in the State to dry the surplus potato crop, A. C. CARTON Lansing, Mich.: Pub. Domain Com., 1915, pp. 43).—This pamphlet reports the findings of the secretary of the Public Domain Commission in his investigation to ascertain the commercial possibilities of dried potatoes or potato flour in the domestic and foreign market, and as to the utilization of the pulp driers in the large sugar and chicory factories.

METEOROLOGY.

The value of high-level meteorological data in forecasting changes of temperature: A contribution to the meteorology of Mount Rose, Nevada, J. P. FRAUENSON (*Nevada Sta. Bul.* 83 (1915), pp. 30, figs. 10).—This bulletin, which supplements an earlier one of the station (*E. S. R.*, 21, p. 14), reports the results of a study of meteorological phenomena at different heights, undertaken with the object of determining, if possible, the value of upper-air data in forecasting frost. The material employed chiefly consists of records obtained simultaneously on the summit of Mount Rose and at stations in near-by

valleys. Analyses of these records have been compared with results of similar researches conducted elsewhere."

Summarizing the results the author concludes that "the general relation or connection between the conditions recorded at the summit and base stations of Mount Rose appears to be practically the same as that found to exist between the summit and base stations of mountains in other parts of the world. Of the decided falls of temperature or cold waves occurring on the summit during four years of observation, about one-half were accompanied by nearly synchronous changes at the base stations; one-third were followed within 48 hours by lower minimum temperatures at the base stations; one-fifth were followed by a slight rise of temperature at the base stations. In the instances where a cold wave on the summit precede those at the base, particularly those where a rise of temperature occurs at the base, the cause is probably local gradients less steep than usual, mechanical cooling of the air at the summit during a strong wind, or clouds or fog in the valleys and below the summit. Such a condition, however, does not appear to be a very stable one and probably can not exist very long. Abnormal falls of temperature or cold waves occur most frequently when a cyclone or area of low pressure is about 500 miles south or southeast, and an anticyclone or area of high pressure about 300 miles northwest of Mount Rose. When well-defined cyclones and anticyclones pass over or near Mount Rose, the changes of temperature at the summit and base are nearly synchronous, for at such a time the winds at all levels are higher than normal and the atmosphere more nearly homogenous."

While the author believes that data from high-level stations, such as are reported in this bulletin, will be found valuable in local forecasting, they should be supplemented by determinations, in some level region, of "the vertical gradients or distribution of the chief meteorological elements by means of recording instruments elevated by kites and balloons and from observations of the formation and movements of clouds. . . . Comparisons of free atmosphere data with observations on mountains and in valleys under various conditions of weather will show the relation of local phenomena to the general movements of the atmosphere."

It is urged that the practical utility of the results of such investigations can be greatly increased by embodying the information in courses of instruction.

Report of the chief of the Weather Bureau, 1915 (*U. S. Dept. Agr., Weather Bur. Rpt. 1915, pp. 276, pls. 4*).—This report follows the general lines of previous years (*E. S. R., 32, p. 810*).

Among the subjects of special interest briefly discussed in the summary report are the progress and present status of snow surveys in mountain watersheds in Utah, Idaho, Wyoming, and Arizona which are being carried on as a means of measuring the water which may later be available for irrigation; a preliminary trial of a scheme of utilizing amateur wireless operators in the distribution of weather forecasts; improvement of the system of storm warning signals on the Great Lakes; and observations on the extent and damage caused by floods.

"The heavy and continued rains of May and June, 1915, in Kansas, Nebraska and adjoining sections, while not producing marked floods in the rivers, nevertheless wrought immense damage to standing crops, not only from overflow and total destruction along the rivers and small streams, but also by reason of the saturated condition of the soil, it being impracticable to gather crops until the ground dried out. An estimate of the damage to crops and farm lands in Kansas places the amount at \$6,000,000, with an additional \$1,500,000 along the Missouri east of Kansas City."

Climatological data for the United States by sections (*U. S. Dept. Agr. Weather Bur. Climat. Data, 3 (1916), Nos. 3, pp. 239, pls. 2, figs. 6; 4, pp. 22*

pls. 2, Figs. 6).—These numbers contain, respectively, brief summaries and detailed tabular statements of climatological data for each State for March and April, 1918.

Climatology of State College, Pennsylvania.—II, Precipitation (rain and snow), W. FEAR (*Pennsylvania Sta. Rpt. 1914, pp. 233-347*).—This is an elaborate discussion of precipitation at State College, Pa., based upon observations from 1880-1913, inclusive. It supplements a similar discussion of the temperature of this place published in a previous report (E. S. R., 34, p. 115).

The records show that the locality belongs to the common class as regards hours of greatest rainfall frequency, namely, that in which rains are least frequent in the hours immediately preceding noon. "The larger precipitation in the afternoon as compared with the morning division of the late spring and summer days is due both to the greater frequency of the rainfall at that time of day, and also to the greater average quantity of the afternoon as compared with the morning rains. In like manner, the night time precipitation is on the average greater than that at other times of day during the remainder of the year, and for the same reason—that the night rains are then the more frequent and more copious." The summer daytime precipitation is about one-half greater than that occurring by night when the total precipitation through the period is considered.

"Considering the number of rainy days in the year, as indicated by the occurrence of measurable precipitation, 1880 with 90 days had the least, and 1911 with 157 days, the most. The average for all years was 130.3 days, or about 4.3 days out of twelve."

The largest precipitation occurred in the summer months; the smallest in the winter. The data give no support to the popular idea of the relation of rainstorms to holidays or to equinoxes.

The average annual rainfall for the period was 39.762 in., and this was distributed by seasons approximately as follows: Winter 8.82 in., spring 10.52 in., summer 11.76 in., and autumn 8.38 in. There was no regularity of annual precipitation. "Of the 30 years for which the records are complete, the annual total falls below the average in 13 cases, and exceeds it in 17 cases. The extreme range is from 30.845 in. in 1887 to 46.545 in. in 1891, a range of 15.7 in., which is more than half of the minimum. The mean between the extremes is 38.695 in., or 1.067 in. below the average." For one-half of the years the annual average was above 40 in.

As regards unsettled weather the winter and spring months showed the greatest frequency and the summer months least. Dry spells, that is, periods of 4 days or more in which less than 0.1 in. of rain fell, were very irregularly distributed among the months, but the last four months of the year showed them in the greater frequency. "That is, the dry spells are most frequent at the season when the number of crops that can be directly affected is least. May stands next in the order of frequency, and represents a critical period in the life of the majority of farm and garden crops, but June had but one dry spell in the thirty years for which the detailed records are at hand; so that it tends, on the average through many years, to compensate for the May fickleness of water supply."

The average seasonal snowfall for the period was 47.18 in. It ranged from 23.01 in. in the winter of 1888-89 to 53.14 in. in the winter of 1907-08. The greatest snowfall of a single month was that of February, 1908, when 41.8 in. fell. The ratio of rainfall to snowfall of the winter season was as 74 of the former to 28 of the latter. The greatest snowfall in any one day was 17.5 in., March 5, 1902.

Meteorology for 1913, H. D. EDMISTON (*Pennsylvania Sta. Rpt. 1914, pp. 390-399, 497-518*).—The observations here recorded are of the same character as those reported in previous years (*E. S. R.*, 34, p. 118). The summary for 1913 is as follows:

Summary of meteorological observations at State College, Pa., 1913.

Kind of observation.	1913	Growing season (April-September).
Barometer (inches): Mean.....	30.02.....	
Temperature (°F.):		
Mean.....	56.6.....	62.6.....
Highest.....	93.0 (July 1).....	93.0 (July 1).....
Lowest.....	4.0 (Feb. 2, Mar. 7).....	25.0 (Apr. 9).....
Greatest daily range.....	37.0 (June 11).....	37.0 (June 11).....
Least daily range.....	33.0 (Apr. 28, Dec. 3).....	
Rainfall (inches).....	39.88.....	18.35.....
Number of days on which 0.01 in. or more rain fell.....	127.....	59.....
Mean percentage of cloudiness.....	49.4.....	44.3.....
Number of days on which cloudiness averaged 80 per cent or more.....	79.....	30.....
Last frost in spring.....		June 10.....
First frost in fall.....		Sept. 9.....

Ohio weather for 1915, J. W. SMITH and C. A. PATTON (*Ohio Sta. Bul. 294 (1916), pp. 349-428, figs. 61*).—The temperature and precipitation throughout the State during each month are shown in charts. The usual summary tables are given showing temperature and rainfall at Wooster and throughout the State (1888 to 1915).

The mean temperature for the year at Wooster was 48.9° F.; for the State, 50.8°. The highest temperature at the station was 91°, July 16; for the State, 96°, July 31. The lowest temperature at the station was -13°, January 24; for the State, -22°, January 24. The annual rainfall at the station was 42.06 in.; for the State, 40.83 in. The number of rainy days at the station was 132; for the State, 123. The prevailing direction of the wind was southwest at the station and in the State at large.

SOILS—FERTILIZERS.

Soil survey of Polk County, Georgia, D. D. LONG and M. BALDWIN (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 46, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture and issued July 5, 1916, deals with the soils of an area of 200,320 acres, comprising parts of the Appalachian and Piedmont Plateau provinces in northwestern Georgia. The greater part of the county is rolling to hilly. Drainage is said to be generally well established. The soils of the area are of residual, alluvial, and colluvial origin. Exclusive of rock outcrop, 31 soil types of 16 series are mapped, of which the Clarksville gravelly loam and the Talladega slate loam cover 33 and 10.1 per cent of the area, respectively.

Soil survey of Jessamine County, Kentucky, R. T. ALLEN (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 20, fig. 1, map 1*).—This survey, issued June 24, 1916, deals with the soils of an area of 110,080 acres in the bluegrass region of east-central Kentucky.

"In the southwestern part the county is hilly and broken, while the northern section is predominantly gently rolling. . . . In general the county is well drained." "The upland soils . . . comprising about 85 per cent of the area, are residual from limestone, except in some comparatively small areas

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in the southwestern section, where they are derived from sandstone." Including rough stony land, seven soil types of five series are mapped, of which the Hagerstown silt loam covers 77.3 per cent of the area.

Soil survey of Gage County, Nebraska, A. H. MEYER, R. R. BURN, and N. A. BENGTSON (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Nebraska Soil Survey and issued June 10, 1916, deals with the soils of an area of 547,840 acres in southeastern Nebraska lying entirely within the glaciated part of the Great Plains province.

"The topography ranges from almost flat or plainlike to rolling, with steep to abrupt slopes along drainage ways, bordered by rather high rock ledges. As a whole the county is well drained." "The soils of the county are classed, on the basis of origin and mode of formation, into four principal groups, (1) soils derived from loess, (2) soils derived from glacial drift, (3) residual or partly residual soils, and (4) alluvial soils." Excluding meadow, ten soil types of ten series are mapped, of which the Carrington, Grundy, and Wabash silt loams cover 51.4, 18.4, and 14.7 per cent of the area, respectively.

The soils and agricultural development of northern New York, E. O. FIPPIN (*Cornell Countryman, 15 (1916), No. 7, pp. 570-575, figs. 4*).—This article deals briefly with the soil characteristics and agricultural conditions of an area of approximately 14,500 square miles, including all of eight counties and parts of six counties in northern New York. The topography is that of a great central mountainous dome receding to low plains. The soils consist of non-agricultural mountain soils, lowland soils, and lake and terrace soils. It is stated that drainage is the most pressing need of these soils and that liming is also necessary.

Soil survey of Wake County, North Carolina, L. L. BRINKLEY, N. M. KIRK, R. T. ALLEN and B. B. DERRICK (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 45, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and issued June 30, 1916, deals with the soils of an area of 537,600 acres lying in the Piedmont Plateau and Coastal Plains regions in central North Carolina. The topography ranges from level to hilly and broken. The county is said to be well drained. The soils are of residual and sedimentary origin. Twenty-two soil types of nine series are mapped, of which the Cecil sandy loam, Durham coarse sandy loam, and Cecil coarse sandy loam cover 21, 14.3, and 10.4 per cent of the area, respectively.

Soil survey of Geauga County, Ohio, C. N. MOONEY, H. G. LEWIS, C. W. OFFLER, and O. GOSSARD (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the Ohio Experiment Station and issued June 30, 1916, deals with the soils of an area of 263,680 acres in the Allegheny Plateau region in northeastern Ohio. The surface varies from flat or nearly flat to gently undulating or rolling and hilly.

"The soils are predominantly silty. They are of glacial origin and derived largely from sandstones and shales of Carboniferous age. According to topographic position and mode of formation the soils fall into three general groups—glacial upland, or unmodified till soils; glacial-lake and river-terrace, or modified till soils; and river flood plain or alluvial soils, with muck and peat, a cumulative formation." Including muck and peat, 16 soil types of eight series are mapped, of which the Volusia clay loam and loam cover 61.7 and 11.4 per cent of the area, respectively.

Some alkali soils in Ohio, J. W. AMES (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 7, pp. 209, 210).—It is stated that the areas of alkali soils in Ohio are located in the southern part of Highland County and in Brown and Clermont counties. Examination of the alkali soil in one case showed contents of magnesium, aluminum, and sulphur equivalent to 4.27 per cent magnesium sulphate and 4.9 per cent aluminum sulphate.

Soil survey of Frederick County, Virginia, J. B. R. DICKEY and W. B. COBB (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils*, 1914, pp. 1/8, pls. 4, fig. 1, map 1).—This survey, issued June 22, 1916, deals with the soils of an area of 274,560 acres in northern Virginia. The county is divided into valley and hill regions, the topography of the former being undulating to rolling. The hill country has excellent surface drainage.

The soils of the county fall into three broad general divisions. "The most extensive division comprises the soils of the Appalachian Mountain province, or the soils derived from shales and sandstones, while the most important agriculturally is that group of soils found in the limestone valley province. All the soils in these provinces are, with possibly one exception, residual. . . . The third division includes the alluvial soils." Including rough stony land, 19 soil types of nine series are mapped, of which the Dekalb gravelly loam, Berks shale loam, and Hagerstown clay loam cover 24.3, 18, and 10.1 per cent of the area, respectively.

The loess soils of the Nebraska portion of the transition region.—I, II, F. J. ALWAY ET AL. (*Soil Sci.*, 1 (1916), No. 3, pp. 197-258, pls. 3, figs. 6).—Two papers are presented.

1. *Hygroscopicity, nitrogen, and organic carbon*, F. J. Alway and G. R. Mc Dole.—Studies, made at the Nebraska Experiment Station, of the hygroscopicity and nitrogen and organic carbon contents of 648 samples of soils, representing the first six foot sections and the 12 inch sections of the surface foot from five virgin prairie fields in each of six areas in Nebraska located between the Missouri River and the western limit of the loess region in which the annual precipitation decreases from more than 30 in. in the east to less than 20 in. in the west and the relative aridity exhibits a still greater range, are reported.

It was found that "the hygroscopicity, as expressed by the hygroscopic coefficient, is strikingly uniform both from field to field in any one area and from the surface downward in the same field. It is lowest in the two western areas and highest in the two eastern. When the different levels from the individual fields are compared, the highest is found in either the second or the third foot, in which two it is very similar. The minimum value is found in the surface foot of the three eastern areas, and in the sixth of the three western. . . .

"The effect of the organic matter upon the hygroscopicity is too slight to be detected, a change of even 100 per cent in the content of this being without distinct influence. The nitrogen content in all the fields decrease from the surface downward. In the surface foot . . . it decreases steadily there being in general about half as much in the twelfth as in the first inch section. The nitrogen in the surface foot decreases by about 50 per cent from the most easterly to the most westerly fields, the difference being such as to permit a definite grouping of the areas. The most easterly areas show as high content in the second foot as do the most westerly in the first. In this let also there is a decrease from east to west, but it does not show the gradual change exhibited in the first foot. In the . . . third to sixth foot . . . the differences are small. . . . The organic carbon in the surface foot is very similar in distribution to that of the nitrogen. The amount of the former is approx

mately twelve times that of the latter, the ratio being uninfluenced by the aridity of the climate. When the inch sections of the surface foot are considered the organic carbon decreases slightly more rapidly than does the nitrogen, the average ratio being 13.4 for the first and 11.3 for the twelfth inch section. In the levels below the first foot also a similar difference in the rate of decrease is observed, the ratio in some cases falling as low as 6. The decrease is less rapid in the western than in the eastern areas, the average organic carbon content in the fourth, fifth, and sixth feet being higher in the two most westerly areas than in the two most easterly, while that of the nitrogen is lower. The decrease in nitrogen and organic carbon in the surface soil from east to west . . . [is] attributed to the greater vegetative growth without a correspondingly more rapid decay in the eastern areas.

"The water of constitution (the difference between volatile matter and organic matter) decreases from east to west, the variations being concordant with those in the hygroscopicity. Compared with the Russian chernozem soils formed on loess, the organic carbon and the nitrogen are low both in the surface soil and in the subsoil, the amounts found in the eastern areas being similar to the minima reported for the chernozem. The subsoils from the semiarid areas, in so far as the nitrogen is concerned, in contrast with the arid subsoils, are as 'raw' as those from the humid areas, not supporting a satisfactory growth of nonleguminous plants."

A list of 26 references to literature bearing on the subject is appended.

II. *Humus, humus-nitrogen, and color*, F. J. Alway and M. J. Blish.—In this report of studies of the humus-nitrogen and color of the soils described in the foregoing article, "the gravimetric method for the determination of humus was found in the case of the subsoils to fail to indicate the relative amounts of ammonia-soluble, dark-colored organic matter present. A colorimetric method is preferable for the subsoils; in the case of the surface soils it is at least fairly satisfactory for the determination of the whole of the ammonia-soluble organic matter."

"Within the surface foot the humus decreases from the first to the twelfth inch and from east to west. The rate of decrease downward is independent of the degree of aridity. In the second foot the decrease from east to west is less marked than in the first, while in the still lower levels the humus, as determined gravimetrically, shows no distinct change from east to west. No marked differences in the percentage of nitrogen in the humus were found between the soils from the most humid and those from the most arid parts of the region. The soluble pigment in the surface foot was found to decrease in passing from east to west, while that in the third to sixth foot increases. A relatively low amount in the surface foot with a relatively high content in the subsoil characterizes the soils from the more arid portion of the region."

"The colors of the soil and subsoils agree in general with the amounts of soluble pigment found by the colorimetric method. . . . The color of the soils in the western areas is lighter, and in all the areas the dark-colored surface layer is shallower than in the typical Russian chernozem. Buried soil surfaces as well as the dark tongues and veins, common in the Russian chernozem, appear to be absent in the loess of the Nebraska portion of the transition region. Gravimetric determinations show the humus of the soils of the western and arid California soils."

A list of 12 references to literature bearing on the subject is appended.

[Composition of caliche], A. E. VINSON and C. N. CATLIN (*Arizona Sta. Rpt.* 315, pp. 567, 568).—Analyses of five samples of caliche are reported, the results

of which are taken to indicate that this soil is well supplied with potassium and phosphorus and that its potassium-sodium ratio is similar to that found in limestone.

Soil colloids, W. T. McGEORGE (*Hawaii Sta. Rpt. 1915, pp. 36, 37*).—Attention is called to the invariable presence of colloidal aluminum hydroxid in Hawaiian soils of high aluminum content. "In all soils which contain iron in excess of alumina, this colloidal gel is never formed."

Absorption and solution of ammonium and phosphate salts, H. STRATMANN (*Über Absorption und Lösungen von Ammonium und Phosphatsalzen, Diss. Univ. Giessen, 1914, pp. 62, figs. 2*).—The work of others bearing on the subject is briefly reviewed, and experiments with a number of soils of different mineralogical origin and composition, including loamy alluvial soils poor in lime, clay, loess, blow sand, stony loam poor in lime, ortstein, marly soil, slaty clay soil, sericite, slate soil rich in potash, weathered gray wacke soil, weathered granite soil, diabase soil, weathered phonolite, basaltic soil, and diluvial sand soil are reported. The purpose was to determine the extent to which the absorptive power of a soil for ammonia and phosphates is influenced by decreasing its content of colloidal material. Solutions of ammonium chlorid and sulphate of concentrations equivalent to 200 cc. of nitrogen per 200 cc. of solution and solutions of monocalcium phosphate, dicalcium phosphate, and diammonium phosphate of a concentration equivalent to 492 mg. of phosphoric acid per 400 cc. of solution were used.

It was found that in mechanical soil analysis the sedimentation of the fine colloidal particles was not a function of the time or the size of the particle, making the results obtained by the decantation method more or less dependent on an unknown factor. The Schön process was found to be more reliable than the decantation process and in modified form was more simple. The absorptive powers of soils of different origin and composition were influenced in a variable manner by the removal of the finest particles, according to the kind of spar sand present. The silicon dioxid present in some basaltic soils, especially in the group of particles of a diameter varying from 0.05 to 0.03 mm., was found to be a new formation from the weathering of bauxite. The components of so-called double silicates were found only in small amounts in many soils of noteworthy absorptive powers. Synthetic silicates could not be characterized as double silicates. Chabazite and stibite minerals of the zeolite group were found to be acid salts. Kaolin, as an acid aluminum silicate, is considered to be fundamentally different from the amorphous aluminum silicates of the soil. The main substance partaking in soil absorption and exchange of ions is considered to be amorphous aluminum silicate, which is the end product of the normal weathering of feldspar.

The influence of a stand of trees on the content of dissolved salts in an upland moor soil, E. RAMANN and H. NIKLAS (*Ztschr. Forst u. Jagdw., 45 (1916), No. 1, pp. 8-11*).—Two years' tests of the concentration of the solutions of an upland peat moor soil supporting a stand of birch, pine, and other trees are reported, using the electrical conductivity method.

It was found that the soluble salt content of the forested soil was generally larger than that of the bare soil and was less only in the fall. The variation in salt content of the soils was the same for both years. The salt content was rather low in May, increased until July, and then decreased until September. It increased in November to its greatest height. Laboratory tests of the dead leaves led to the conclusion that the rise in salt content in the soils in November was due to leaching out of the soluble salts in the dead leaves.

A preliminary statement on the present status of the humus nitrogen problem in arid soils, C. B. LIPMAN (*Soil Sci.*, 1 (1916), No. 8, pp. 235-290).—The author reviews experimental work by himself and others conducted for the most part at the University of California.

The results are taken to indicate that "the method of determining humus nitrogen in the ammonia extract of soils is a seriously faulty one, no matter how much care is employed in boiling the extract with magnesia. The method is so faulty as to deserve immediate rejection by all those who are at all concerned with the correct determination of nitrogen in humus. If the results given are considered in connection with the largest part of the humus nitrogen data furnished by Loughridge [*E. S. R.*, 34, p. 324], there can be no question that the prevalent belief in the high nitrogen content of the humus of arid soils is in error. The facts in hand do not justify any belief in the higher nitrogen content of the humus in either the arid or the humid group of soils over each other."

A list of five references to literature bearing on the subject is appended.

A contribution to the subject of the factors concerned in soil productivity, C. HOFMANN (*Kans. Univ. Sci. Bul.*, 9 (1914), No. 7, pp. 79-89, pls. 5).—Laboratory experiments conducted at the University of Wisconsin with normal peat, sandy, and marsh soils to determine (1) the influence of the growth of pure cultures of soil organisms in sterile soil on the growth of wheat, corn, and clover seedlings in the extract of such soil, and (2) the influence of the growth of corn, oats, and clover in the same soil on pure cultures of bacteria grown in the extracts of such soil are reported.

It was found that "the growth of individual species of bacteria in a soil produces changes in the soil solution which manifest themselves by an increased or decreased development of plant seedlings when grown in extracts made from such soils. Invariably this influence seems to affect the root development rather than the leaf development. In repetitions of the same experiment consistent results are secured as long as all three factors, soil, bacterial species, and crop, are the same. A change of any one factor modifies the results secured. The growth of individual species of crops in a soil produces changes in the soil solution which manifest themselves by an increased or decreased bacterial multiplication in extracts made from such soils. The extracts made from a marsh soil cropped by corn, oats, or clover in all cases stimulated bacterial multiplication. This stimulation was consistently greatest in the case of the corn-cropped soil. In contrast to the marsh, the extracts from the cropped loam and sand soils invariably retarded the multiplication of the bacteria grown in the same. There is a definite relation between the growth of crops in soil and the growth of bacteria therein. . . .

"Owing to the variability of the three factors involved, soil, crop, and bacterial flora, it is impossible to establish any hard and fast laws for all cases."

Incubation studies with soil fungi, S. A. WAKSMAN and R. C. COOK (*Soil Sci.*, 1 (1916), No. 3, pp. 275-284, fig. 1).—Ammonification experiments conducted at the New Jersey Experiment Stations with *Mucor plumbeus*, *Penicillium* sp., and *Monilia sitophila* in pure culture in a gravelly loam soil, using dried blood and cotton-seed meal as ammoniates, are reported.

The results obtained are taken to indicate that "optimum moisture conditions for ammonia accumulation by fungi lie near the physical optimum. The proper incubation period depends entirely upon the organism. A 12-day incubation period is preferable to a shorter one for practical work. A correlation exists between the biological stage of the organism and the periods of ammonia accumulation; the largest amount seems to accompany the periods of spore

germination and the smallest amount the time preparatory to actual spore formation. *M. sitophila* shows the largest ammonia accumulation within the first 3 or 4 days; *Penicillium* sp., between 10 and 15 days; and *M. plumbeus*, between 6 and 10 days. These periods correspond to those of active spore formation for the respective organisms."

Preliminary experiments on some effects of leaching on the soil flora. C. B. LIPMAN and L. W. FOWLER (*Soil Sci.*, 1 (1916), No. 3, pp. 291-297).—Preliminary laboratory experiments conducted at the University of California on the processes of ammonification, nitrification, nitrogen fixation, and cellulose decomposition in clay loam and blow-sand soils when unleached and leached in the presence or absence of 0.1 per cent sodium chlorid, 0.25 per cent sodium sulphate, 0.05 per cent sodium carbonate, or a combination of 0.1 per cent sodium chlorid, 0.05 per cent sodium carbonate, and 0.1 per cent sodium sulphate, are reported.

The results obtained are taken to indicate that "leaching affects the bacterial flora of soils profoundly. . . . This is particularly so for the nitrifying, nitrogen-fixing, and cellulose-destroying organisms. All of these processes appear to be wholly or almost wholly checked by leaching, especially if salts are present prior to the execution of the latter process."

A list of seven references to literature bearing on the subject is appended.

Nitrification in relation to the reaction of the soil. J. W. WHITE (*Pennsylvania Sta. Rpt.* 1914, pp. 70-80, pls. 4).—Studies of nitrification and the nitrate content of acid soils and soils made acid, especially by treatment with ammonium sulphate, are reported, the results of which are taken to indicate that nitrification does not cease in very acid soils. Soil on which corn and wheat failed was found to be liberally supplied with nitrates.

"The absence of nitrates under growing plants is no indication of the inactivity of nitrifying organisms. The variation in nitric nitrogen content of all areas on ammonium sulphate plats is parallel to the unequal distribution of vegetation. An average plat showed 24.91 parts per million of nitric nitrogen in corn stubble, 13.14 parts per million on clover sod, 9.23 parts per million under clover and timothy, and 36.47 under winter wheat."

Applications of burned lime and ground limestone to soil from the plat materially stimulated the activity of nitrifying organisms. Magnesians lime gave higher nitrates than pure lime. Failure of clover, corn, and wheat was "not due to the absence of available nitrogen as nitrates. . . . On the basis of 256 nitric nitrogen determinations, indications are that nitrification is still active on the very acid soils of the ammonium sulphate plats."

The effect of 1.14 in. of rainfall upon the nitric nitrogen and acid content of plat 32. J. W. WHITE (*Pennsylvania Sta. Rpt.* 1914, pp. 67-70).—Studies of evaporation from a soil during a period of drought and of the capillary movement of water-soluble nitrogen and acids or acid salts before and after a heavy rainfall are reported.

It was found that "the 1.14 in. of rainfall penetrated the soil to a depth of 15 in. There was a total loss of 4 per cent of moisture from the surface soil [growing wheat] between August 18 and September 6." The moisture content of the surface 3 in. of soil, as the result of 1.14 in. of rain September 21, increased in corn soil from 7.11 to 18.86 per cent, in clover soil from 8.72 to 17.0 per cent, and in wheat soil from 6.81 to 16.76 per cent. The corn soil "showed an enormous accumulation of nitrates where corn failed. The difference in nitric nitrogen content of the three areas studied is due for the most part to the presence or absence of vegetation."

As the result of the rain there was a loss of nitrogen from the corn soil as follows: 0 to 3 in., 80.75 lbs. per acre; 0 to 6 in., 61 lbs. per acre; and 0 to

24 in., 68.86 lbs. per acre. "Plat 32 shows considerable accumulation of soil acids to a depth of 24 in. At this depth there was found in [the corn soil] 3,221, [clover soil] 1,800, and [wheat soil] 2,500 lbs. per acre 7 in., expressed in terms of calcium carbonate required to neutralize the acids present. The decrease in the acid content of the surface 3 in. before and after the rain was as follows: [Corn soil] 1,661, [clover soil] 1,152, and [wheat soil] 847 lbs. per acre, expressed in their calcium carbonate equivalent."

Stimulating influence of arsenic upon the nitrogen-fixing organisms of the soil, J. E. GREAVES (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 11, pp. 389-416, figs. 5).—In addition to the findings noted in a previous report (*E. S. R.*, 32, p. 720), this report, prepared at the Utah Experiment Station, brings out that "arsenic can not replace phosphorus in the vital process of the nitrogen-fixing organisms, but it can in some manner liberate the phosphorus from its insoluble compounds. This may be either a direct or an indirect action. Arsenic stimulates the cellulose ferments, and these in turn react upon the activity of the nitrogen-fixing organisms. The nitrogen-fixing powers of soil extract, of filtered soil extract, and soil dried for some time are only slightly stimulated by arsenic, showing that arsenic acts mainly by the removal of a thermolabile body which occurs in the soil."

Can soil be sterilized without radical alteration? D. A. COLEMAN, H. C. LINT, and N. KOPELOFF (*Soil Sci.*, 1 (1916), No. 3, pp. 259-274, figs. 2).—Preliminary experiments conducted at Rutgers College on clay-loam soil to determine (1) the effect of intermittent sterilization of soil by dry heat, (2) the relative sterilizing efficiencies of volatile chemical substances when used as soil antiseptics, and (3) the effect of volatile antiseptics applied in partial vacuum and under pressure at 80° C., are reported.

It was found that "intermittent sterilization by means of dry heat at 82° for five successive days in moist soil almost completely decimated the bacterial flora of the soil. This was accomplished with but a slight change in the chemical constitution of the soil, as indicated by the amount of water-soluble solids. Ordinary steam sterilization under pressure causes a change 16 times as great. There is a strong indication that the application of volatile antiseptics either in partial vacuum or under a combination of heat and pressure, if repeated for more than three successive days, would achieve complete soil sterilization without involving any radical alteration in the chemical constitution of the soil."

A list of 14 references to literature bearing on the subject is appended.

The effect of partial sterilization on plant growth, W. T. McGEORGE (*Hawaii Sta. Rpt. 1915*, pp. 37, 38).—Pot experiments with red clay and a sandy soil high in organic matter growing onions, millet, and cowpeas are reported. "These soils were treated as follows: Heated in sunlight in an oven at 80, 110, and 165° C., and in an autoclave at 10 lbs. pressure. Those heated in the oven were left for two hours, that in the autoclave for only one hour. In addition, soils were treated with the following antiseptics at the rate of 10 cc. per kilogram: Carbon bisulphid, chloroform, and toluene. . . ."

"The influence of partial sterilization upon onions was very marked. Volatile antiseptics produced a [marked] increase, while heating in the autoclave was productive of a substance evidently toxic toward this plant. An increase in vigor of the millet plant was correlated with an increase in temperature at which the soil was sterilized. The plants are more vigorous in the pots sterilized by heat than those sterilized by antiseptics. It appears that the organic substance having a toxic influence upon onions is without effect upon millet, for in the pot heated in the autoclave the plants are as vigorous as any others. "In case of cowpeas, the increase in temperature at which the soils were sterilized resulted in a steady decrease in vigor. While the volatile antiseptic low-

ered the vigor to a slight extent, their influence is not so marked as heat. These results clearly show the intimate relationship between leguminous plants and bacterial life in the soil."

Variation in the growth of clover on Mitchell field (A), J. W. WHITE (*Pennsylvania Sta. Rpt. 1914, pp. 65, 66, pls. 2*).—Studies of the lime requirement, the contents of acid-soluble calcium and magnesium oxides and phosphoric acid, and the total nitrogen of a soil in a field where clover grew both well and poorly showed that the irregular growth of the clover was due to the unequal distributions of basic material which controls the reaction of the soil.

"The growth of clover and the lime requirement are in close accord. No other one factor bears such a close relation to the growth of clover. . . . [Considering] the sum of the lime and magnesia, which forms the determining factor so far as the reaction of the soil is concerned, the two bear relations parallel to the lime requirement, though in an opposite direction. . . . The limit of acidity may vary with the fertility of the soil, or possibly with a difference in the kind of free acid present."

Soil management problems (*Wisconsin Sta. Bul. 268 (1916), pp. 26-32, figs. 4*).—The general results obtained in experiments on the management of silt loam, clay, and sandy soils, the effect of cultivation on soil acidity, the correction of soil acidity with limestone waste from lead and zinc mines, fixation of nitrogen in acid soils, and nitrate formation in different soil types are briefly noted.

[**Reclamation of alkali soils**], J. H. BARNES (*Rpt. Dept. Agr. Punjab, 1915, App., pp. IV, VI-IX*).—Studies of nitrogen fixation, ammonification, nitrification, and carbon dioxide production in barren alkali soils at Narwala in the Punjab district before and after mole drainage, cultivation, and flooding with canal water are reported in tabular form, showing a marked increase in bacterial activity following such treatment.

[**Soils and fertilizers**], N. H. J. MILLER (*Ann. Rpts. Prog. Chem. [London], 12 (1915), pp. 211-233*).—This section summarizes the results of recent investigations relating to soils and fertilizers.

Effect of fertilizers on soil structure as indicated by the draft of a plow, C. F. NOLL (*Pennsylvania Sta. Rpt. 1914, pp. 36-46, pls. 2*).—Dynamometer tests made on plats of clay and silt loam soil, treated since 1882 with commercial fertilizers, lime, manure, lime and manure, and land plaster are reported.

"The plats are divided into four series or tiers of 36 one-eighth acre plats each, on which are grown each year in rotation, in the order named, corn, oats, wheat, and mixed clover and timothy. The dynamometer tests were begun in the fall of 1911 and were repeated each time a tier of plats was plowed. Three series of tests were made in plowing sod, three in plowing corn stubble, and three in plowing oat stubble. . . . On each plat two tests were made at one plowing near the ends of the plats and each was for a distance of about 50 ft."

It was found that "the fertilizer treatment has had little influence on the soil structure. The nitrate of soda applied at the rates of about 160, 320, and 480 lbs. per acre has not materially affected the physical properties of the soil. The draft has been about the same on four manured plats as on complete commercial fertilizer plats alternating with them. The presence of more organic matter in some of the soils has slightly lightened their draft."

Meadow fertilization experiments, M. STEIN (*Deut. Landw. Presse, 41 (1916), No. 21, pp. 178-180*).—Five years' experiments on loamy sand, loam humus sand, marshy sand, and shallow mountain meadow soils of seven different localities of the Province of Saxony are reported.

It was found that artificial fertilization with potash and phosphoric acid in general improved the quality and increased the yield of the crop. When nitrogen fertilization was also employed, especially on grass, the yield was further increased. Nitrogen fertilization improved grain crops, but continued fertilization with potash and phosphoric acid alone generally became gradually injurious. On poorly drained soils fertilization had little effect.

Fertilizer ratio experiments with grass on Hagerstown loam, C. F. NOLL, O. SCHREINER, and J. J. SKINNER (*Pennsylvania Sta. Rpt. 1914, pp. 22-26, pls. 2*).—Field experiments in which acid phosphate, sodium nitrate, and potassium chlorid were applied to silt loam soil for four years in 66 different fertilizer ratios of phosphate, nitrate, and potash graded in 10 per cent stages are reported. "The total amount applied on each plat totaled 50 lbs. per acre of the fertilizer elements, P_2O_5 , NH_4 , and K_2O alone or in combinations of two or three of these. The plats were located in a permanent pasture field where the composition of the pasture was chiefly Canada blue grass, Kentucky blue grass, and timothy with a very little white clover and red clover."

The various phases of the results obtained are presented by means of the triangular diagram employed by the Bureau of Soils of the U. S. Department of Agriculture in solution culture experiments in studies of organic soil constituents (E. S. R., 24, p. 32; 26, p. 224).

It was found that "used alone, nitrate has given a large increase over the untreated plats in yield of hay, while both phosphate and potash have yielded a little less than the checks. With increase in percentage of NH_4 applied as nitrate, the yields have increased, and with increase in percentage of either P_2O_5 or K_2O the yields have not increased. The plats [receiving] 50 per cent or more of NH_4 as nitrate have considerably exceeded in yield those in the subtriangles which have received 50 per cent or more of P_2O_5 or K_2O . There has been a slightly greater response from K_2O than from P_2O_5 . The slight differences in the texture of the soil on the different plats have had little influence on the yields. The depth of surface soil has had a marked influence upon the yield."

Legumes as green manure, W. T. McGEORGE (*Hawaii Sta. Rpt. 1915, pp. 32, 33*).—Pot experiments made by A. R. Thompson with a calcareous soil and a soil poor in lime in which 32 varieties of legumes were grown are reported. At maturity the duplicate plants in two pots were removed, weighed, and the nitrogen content determined. Two pots were left of each variety of legume planted, the plants being turned under to decompose.

"In all instances the [content of] nitrates in the soil from which the legumes had been removed was much lower than in the check soil, but these soils low in nitrates on standing in the open air soon equaled in nitrate value the soil of the check pots. Where much legume material was turned under the nitrates in the soils were greatly increased. The plants grown in soils deficient in lime made a poor growth and had a lower nitrogen content, calculated on a water-free basis, than the plants grown in soils rich in lime. In a second experiment lime was added to the lime-poor soil, but the plants grown in this soil were also undersized and low in nitrogen."

Legume inoculation and nitrogen fertilization on upland moor meadows and pastures, B. TACKER (*Mitt. Ver. Förd. Moorkultur Deut. Reiche, 34 (1916), No. 3, pp. 37-47*).—Experiments on the possibility and practicability of substituting nitrogen fertilization for inoculation of soil by nodule bacteria for leguminous pasture and meadow crops are reported.

The results are taken to indicate that nitrogen fertilization can replace inoculation only where more or less active nodule bacteria are present in the soil in sufficient numbers and distribution. The substitution of nitrogen

fertilization for inoculation is probably most advantageous in cases where the inoculating substance is difficult to obtain or use at the proper time. Inoculation in every case noted was cheaper than nitrogen fertilization. The advantage of nitrogen fertilization was greater the shorter the time since the soil had been broken.

The influence of the distribution of nitrogenous fertilizers and straw in soil on plant production, B. NIKLEWSKI (*Ztschr. Landw. Versuchs. Österr.*, 18 (1915), No. 12, pp. 674-690).—Pot experiments with oats on a sandy loess soil deficient in plant food to determine the influence of distribution in the soil on the action of sodium nitrate, ammonium sulphate, liquid manure, peptone, and straw are reported.

The influence of nitrogen fertilization on plant production was found to be determined, next to total amount, by its concentration. A greater increase in crop yield was obtained by distributing ammonium sulphate in the soil in a layer than by mixing generally a double quantity with the soil. The favorable influence of distribution in a layer was especially marked when using the smaller amounts, a saving being thereby obtained.

The influence of distribution was found to vary with the speed of diffusion of the different fertilizers in the soil, the greatest influence being evident for peptone and the least by sodium nitrate. The effectiveness of a fertilizer was also found to depend not only on its physiological value but also on its speed of diffusion in soil. The influence of the speed of diffusion of a fertilizer could be diminished by distribution in the soil and the value of the fertilizer thereby altered.

By intermixing with soil in lower concentrations the best results were obtained with sodium nitrate, followed in order by ammonium sulphate and peptone. By placing in the soil in a layer in higher concentrations the best results were obtained with peptone, followed in order by ammonium sulphate and sodium nitrate.

The concentration of the fertilizers appeared to influence strongly the microbiological processes of the soil and also plant development.

The straw had an unfavorable influence on the utilization of ammonium sulphate in lower concentrations and a favorable influence in higher concentrations. This result is considered an important factor in determining the proper use of liquid manure and the availability of nitrogen in stable manure. Straw had a favorable influence on the utilization of sodium nitrate in lower concentrations, but was without influence in higher concentrations. Straw hastened the diffusion of sodium nitrate in soil, especially in lower concentrations.

Pot fertilizer experiments with new nitrogenous fertilizers, M. PÖPP (*Abt. Deut. Landw. Gesell.*, 31 (1916), No. 4, pp. 54-57).—Pot experiments with oats on a sandy soil deficient in humus to determine the relative fertilizing values of ammonium nitrate, sodium nitrate, ammonium sulphate, sodium-ammonium sulphate, ammonium bicarbonate, ammonium chlorid, two kinds of urea, urea nitrate, lime nitrogen, and granulated lime nitrogen when added in amounts equivalent to 0.5, 1, 1.5, and 2 gm. of nitrogen per 10 kg. of soil are reported.

With reference to crop yield the best results, not considering lime nitrogen, were given by sodium nitrate, followed in order by ammonium chlorid, ammonium sulphate, urea nitrate, ammonium bicarbonate, ammonium nitrate, urea, and sodium-ammonium sulphate. With reference to both crop yield and nitrogen utilization sodium nitrate again gave the best results, followed in order by ammonium sulphate, ammonium nitrate, ammonium chlorid, urea nitrate, urea, sodium-ammonium sulphate, and ammonium bicarbonate. Urea obtained by synthetic process gave the poorest results in both cases.

It was further found that ordinary lime nitrogen gave considerably less favorable results than ammonium nitrate, while the granulated lime nitrogen in the smallest and medium applications gave results comparable to those obtained by others.

Nitrogen fertilization experiments by the German Agricultural Society in 1914-15, E. RITTER and KLEBERGER (*Mitt. Deut. Landw. Gesell.*, 31 (1916), No. 3, pp. 39-53).—Two sets of experiments with oats, potatoes, and beets on 0.125 hectare plats (about 0.31 acre) of deep mild loam, sandy to loamy gravel, mild sandy loam, and heavy clay soils are reported.

In the first set it was found that the lime nitrogen as a part of the basal fertilizer gave generally better results than ammonium sulphate as part of the basal fertilizer on mild and heavy loam, clay, and gravel soils. The results are further taken to indicate that the use of lime nitrogen as a top-dressing for oats is advisable only when necessary.

In the second set, comparing lime nitrogen with ammonium carbonate, the increase in yield of potatoes and beets was greater with increasing nitrogen additions, little difference being observed between the two nitrogenous fertilizers. The best effects of nitrogen fertilization were observed on the gravelly soil. The starch content of potatoes decreased with increasing nitrogen applications. The number of diseased and imperfect potatoes and beets increased with increasing additions of lime nitrogen, and this is taken to indicate that the use of larger amounts of lime nitrogen should be undertaken with caution and only after preliminary local experiments.

A brief note of experiments on the use of catalytic fertilizers with lime nitrogen is also included.

Experiments with nitrogenous fertilizers at the Finnish moor culture experiment station in 1911 to 1913, A. RINDELL (*Finska Mosskulturför. Årsbok*, 18 (1914), No. 1, pp. 53-98; *abs. in Zentr. Agr. Chem.*, 44 (1915), No. 7, pp. 229-302).—Experiments with oats on moor soil which was first burned and then treated with loam soil at the rate of 150 cubic meters per hectare (73.4 cu. yds. per acre) showed that on such soil both sodium nitrate and stable manure markedly increased the crop yield.

In experiments with burned and unburned moor soil, it was found that the burned soil gave the better results the first year but poorer results thereafter. Nitrogen fertilization was found in further experiments to be profitable in both burned and unburned soil.

Experiments comparing sodium nitrate, ammonium sulphate, and carbid nitrogen for oats showed that the fertilizing value of ammonium sulphate was 33 per cent and of carbid nitrogen 64 per cent of that of sodium nitrate on moor soil. Ammonium sulphate was found to be as good a top-dressing for meadow on loam soil as sodium nitrate, while carbid nitrogen gave less favorable results.

The action of gaseous ammonia on superphosphate and the utilization of the so obtained ammonium phosphate. GERLACH (*Ztschr. Angew. Chem.*, 29 (1916), No. 3, *Aufsatzteil*, pp. 13, 14; No. 5, *Aufsatzteil*, pp. 18-20).—An ammonium phosphate fertilizer obtained by treatment of superphosphate with gaseous ammonia is described, and pot and plat experiments with oats, barley, and mustard on loamy sand, sandy loam, and sand containing 5 per cent peat are reported, using the ammonium superphosphate mixture and ammonium phosphate obtained by treating the ammonium superphosphate with cold water saturated with carbon dioxide. Analysis of the ammonium superphosphate mixture showed it to contain total nitrogen 7.15 per cent, total phosphoric acid 16.73 per cent, water-soluble phosphoric acid 1.13 per cent, and total lime 24.78 per cent.

It was found in the experiments that the ammonium phosphate gave as good results, both as a nitrogenous and phosphatic fertilizer, as the ammonium-superphosphate mixture.

Availability of mineral phosphates for plant nutrition. W. L. BURLISON (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 13, pp. 485-514, pls. 8).—A review of literature bearing on the subject is given, and 3½ years' experiments conducted at the Illinois Experiment Station on (1) the availability of phosphorus in Tennessee brown rock phosphate for wheat, oats, rye, barley, corn, peas, timothy, red clover, and alfalfa, (2) the comparative productive powers of six mineral phosphates for farm crops, (3) the influence of fermenting dextrose and crop residues on the availability of phosphorus in finely ground rock phosphate, and (4) the influence of the size of particles on the availability of phosphorus in mineral phosphates are reported.

It was found that "phosphorus in rock phosphate can be assimilated by farm crops in sand cultures under greenhouse conditions, even in the absence of decaying residues. Crop residues, when employed in conjunction with brown rock phosphates, were beneficial. Tennessee brown rock phosphate, Florida soft rock phosphate, and Tennessee blue rock phosphate in the heavier applications proved superior to South Carolina land rock phosphate, Utah rock phosphate, and Canadian apatite, for oats, clover, and cowpeas when grown in sand. The phosphorus in brown rock phosphate and Florida soft rock phosphate was more soluble in water and in plant-food solutions than the phosphorus in other mineral phosphates. The superiority of these two phosphates over the others tested is shown chiefly by the first crop.

"Chemical analysis showed that the plant-food solutions applied did not appreciably modify the results. The cereals produced as satisfactory yields as the legumes.

"The crop yields tended to increase as the application of rock phosphate increased up to a point where the size of the pots seemed to be a limiting factor, apatite being the only exception. The plants obtained their calcium as well as their phosphorus, from brown rock phosphates. No better results were secured when calcium carbonate was applied than when rock phosphate alone was used. There was no particular relation between the citric-acid-soluble phosphorus and the availability of these phosphates for plants. Dextrose, when used as a fermentable substance, was harmful.

"The degree of fineness is a factor which determines to some extent the availability of rock phosphate, as indicated by the brown rock."

A list of 32 references to literature bearing on the subject is appended.

Raw rock phosphate v. acid phosphate. C. E. THORNE (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 6, pp. 183-192).—Experience at several of the state experiment stations is reviewed and 20 years' experience at the Ohio Station briefly summarized, from which it is concluded "that raw phosphate rock is a useful carrier of phosphorus and may be used with profit on soils requiring phosphorus; but . . . when raw phosphate and acid phosphate have been used side by side under such conditions as to fully utilize the crop feeding power of the two materials the acid phosphate has generally furnished available phosphorus at a lower cost than the raw phosphate. . . .

"In the 20-year experiments of the Ohio Station . . . the largest recovery of phosphorus has been three-fourths of that applied in acid phosphate."

The inter-relationships between the constituents of basic slag. S. H. COLLINS and A. A. HALL (*Jour. Soc. Chem. Indust.*, 34 (1915), No. 10, pp. 526-530, figs. 5; *abstr. in Chem. Zentrbl.*, 1915, II, No. 8, p. 431).—Plat experiments with hay on soil varying from heavy boulder clay to medium loam, uniformly

deficient in phosphoric acid but rich in humus, are reported, in which 11 different slags were used as fertilizer at the rates of 50 and 200 lbs. of phosphoric acid per acre. The results of analyses of the slags are also reported, and a correlation of these with the citric solubility of the slags and with the results of the plat experiments indicated that phosphate is the most important constituent of slag, while magnesium, manganese, and iron stand second in importance and are of about equal weight. "There seems much reason for supposing that a balance of the secondary constituents is needed. . . . Medium proportions of magnesia, manganese, and iron are all useful, but extra large proportions harmful."

Experiments on the solubility of the phosphoric acid in Thomas meal in water saturated with carbon dioxide, J. G. MASCHHAUPT (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 17 (1915), pp. 97-141, figs. 5; abs. in Chem. Zentrbl., 1915, 11, No. 10, p. 552*).—Experiments with 59 samples of Thomas meal are reported, the ratios of Thomas meal to water used being 1:4,000, 1:2,000, 1:1,000, 1:500, 1:250, 1:125, 1:100, and 1:50.

It was found that the amount of phosphoric acid dissolved from Thomas meal by contact with water saturated with carbon dioxide depended in large measure on the ratio of Thomas meal to water. The more narrow this relation was the stronger was the influence of the free calcium oxide and calcium silicate in the Thomas meal on the solubility of the phosphoric acid. Thomas slag meals of different citrate solubility showed also different solubilities of their phosphoric acid in water saturated with carbon dioxide. Samples of high citrate solubility yielded the greater amounts of phosphoric acid by the carbon dioxide water method. After a certain number of extractions the solubility of the phosphoric acid in the different Thomas meals became uniform.

The amount of calcium not combined with phosphoric acid appeared to be about the same in the different samples tested. The content of the free lime was greater the smaller the citrate solubility, while the content of calcium silicate was greater with greater citrate solubility. It is thought that the varying citrate solubility is only in small part due to the variable content of free calcium. When the free calcium was separated out the solubility of the phosphoric acid by extraction with 2 per cent citric acid and with water saturated with carbon dioxide was increased but the differences in solubility still existed. These differences are attributed to the calcium phosphate itself, which it is thought may exist in a double compound of calcium phosphate and calcium silicate. Further experiments showed that in spite of the smaller differences in citrate solubility important differences in solubility as indicated by the first extraction with water saturated with carbon dioxide could enter.

The results are taken to indicate that the relations found between citrate solubility and solubility in carbon dioxide water do not yet show that the citrate solubility can be used to indicate the value of Thomas meal.

Results of geological investigation of phosphorite beds in Russia, 1913, I. A. SAMOILOV (J. SAMOILOFF) (*Otchet Geol. Issledov. Fosfor. Zalezhi. 6 (1914), pp. 1-29; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1594, 1595*).—Investigations of the phosphorite beds of east and northeast European Russia, central European Russia, and central Asia are reported.

It was found that in the eight Provinces and regions the deposits cover an area of 1,840 square miles. "Adding this area to that discovered in the years 1908-1912, the total area becomes 4,510 square miles, containing not less than 3,300,000,000 tons of phosphorites, reckoning the yield at about 5 cwt. per square yard. These phosphorites may be divided into three groups according

to their phosphoric acid content. The first group, containing from 12 to 13 per cent of P_2O_5 , represents 72.9 per cent of the whole; the second, with from 18 to 24 per cent represents 22.9 per cent; the third group, containing more than 24 per cent, represents only 4.2 per cent of the total. The total quantity of phosphoric acid in this mass of phosphorites exceeds 500,000,000 tons."

Phosphates and dolomites of Johnson County, Tennessee, O. P. JENKINS (*Resources Tenn.*, 6 (1916), No. 2, pp. 51-106, pl. 1, figs. 12).—This report deals with the geology, mineralogy, and composition of the phosphate and dolomite deposits of the county and reports chemical analyses of samples. Some of the principal phosphate rocks contain over 60 per cent calcium phosphate.

"Chemically, calcium forms the base of the phosphate. Fluorine is present in amounts varying from about 1 to 1.5 per cent. Carbon dioxide is also present, in amounts varying from a fraction to nearly 3 per cent, and appears to vary pretty closely with the fluorine. Insoluble siliceous matter runs rather high, while iron and aluminum oxide are not much above the commercial limit, averaging about 5 or 6 per cent.

"The so-called limestones of Johnson County prove to be highly magnesian, and all those analyzed fall well into the class of dolomites, many of which are very high in content of calcium and magnesium carbonate. The dolomites, as well as some of the shales, are shown by analysis to contain from a trace to over 2 per cent lime phosphate. . . . The phosphate rocks occur in many pockets, scattered over the foothills of the main valleys, which lie near Mountain City. . . . It appears that the phosphate is generally too low grade to be of wide commercial use at present."

Experiments with lime and waste carbonate of lime, 1913 and 1914. A. LAUDER, T. W. FAGAN, and J. T. STEELE (*Edinburgh: Edinb. and East of Scot. Col. Agr.*, 1915, pp. 10).—Two years' experiments in three different localities with turnips on medium loam soil known to be affected with finger-and-toe disease, to determine the effect of quicklime and waste carbonate of lime when added with complete fertilization at the rates of 1, 2, 3, and 4 tons per acre, are reported.

The results obtained are taken to indicate "that a certain minimum amount of lime must be present in each soil. Beyond this point an increase in the amount of lime gives an increase in the effect. For the soils under experiment this limit may be placed at from 1 to 2 tons per acre. The results confirm those of work carried out elsewhere as to the beneficial effects of ground lime and carbonate of lime on land affected with finger-and-toe [disease]. When waste carbonate of lime is available it may be employed instead of ground lime for neutralizing soil acidity with satisfactory results. It should be applied at twice the rate of ground lime. For land which has not been limed for a considerable time, dressings of 2 tons of ground lime or 3 to 4 tons of the waste carbonate may profitably be given. When once the deficiency in lime in the soil has been made good, dressings of 10 cwt. to 1 ton per acre of ground lime should be applied at regular and frequent intervals, rather than heavy dressings at long intervals."

Effect of quicklime on organic matter in soils, F. E. BEAR (*Jour. Amer. Soc. Agron.*, 8 (1916), No. 2, pp. 111-113).—Experiments conducted at the West Virginia Experiment Station with a silt loam soil, used in fertilizer experiments at the station as noted by Bear (*E. S. R.*, 35, p. 22), are reported.

The results show that "in every case the plot receiving quicklime, as compared with the plot receiving a corresponding fertilizer application without quicklime, shows a lower content of both nitrogen and carbon. . . . The results indicate that quicklime does reduce the amount of carbon and nitrogen in the soil."

Experiments with catalytic manures, I. GIANNOSI (*Italia Agr.*, 52 (1915), No. 10, pp. 455-458; *abs. in Internat. Inst. Agr. [Rome]*, Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, p. 1596).—Field experiments with hemp conducted at the Royal Agricultural College at Bologna, Italy, to determine the influence of catalytic fertilizers containing 7.32, 9.32, and 7.08 per cent of the manganese tetroxid, when applied in amounts varying from 220 to 305 lbs. per acre, are reported.

The best yield was obtained on a control plat and the poorest on a plat receiving the catalytic manure, but the differences in the results from different plats were so small as to be within the limits of experimental error. It is concluded that the catalytic manure had no appreciable effect.

Composition of some oil cakes used as fertilizer in Tonkin [Indo China], BLOCH (*Bul. Écon. Indochine, n. ser.*, 18 (1915), No. 115, pp. 757, 758).—Analyses of ten samples of oil cake are reported, showing contents of nitrogen varying from 1.02 to 4.76 per cent, potash in four cases varying from 0.042 to 0.3 per cent, and phosphoric acid in four cases varying from 0.203 to 1.955 per cent.

AGRICULTURAL BOTANY.

Starch congestion accompanying certain factors which retard plant growth, B. L. HARTWELL (*Rhode Island Sta. Bul.* 165 (1916), pp. 23).—It having been observed that accumulation of starch in potato vines followed a deficiency of available potassium in the soil, a series of investigations was undertaken to determine whether the deficiency of the element in question might inhibit cell development, causing less demand for starch, or whether potassium was essential as an activator of diastatic action.

As a result of the investigations it was found that an accumulation of starch seems to be correlated in general with conditions which cause a retardation of growth. The different factors which result in the accumulation of starch in the above-ground portion of the plant do not appear to interfere with photosynthesis, but it is thought that they may have some influence on subsequent metabolism.

Potato tuber production above ground, V. VILKOVSKÝ (*Věstník 5. Sjez. Čes. Lék. Pěst.*, 1915, p. 412; *abs. in Bot. Centbl.*, 129 (1915), No. 15, p. 572).—The author supports the view that the formation of tubers on the potato plant above ground is due to the excessive storing of starch. This is to be regarded as not necessarily pathological but as the result of producing starch faster than it can be removed to its more usual situation in the underground tubers.

The origin of anthocyanin pigments, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris]*, 161 (1915), No. 19, pp. 567-570).—The author discusses the two main hypotheses supported by different investigators regarding the origin of anthocyanin, the one being that anthocyanin pigments result from the transformation of colorless phenol compounds previously formed in the cells and the other that these pigments are formed in place directly as colored products. He agrees with the later views of Combes (*E. S. R.*, 32, p. 824) in holding, as the result of his own investigations (*E. S. R.*, 35, p. 333), that while anthocyanin is in a large number of cases found in the mitochondrial body, it may under different circumstances be derived also from the transformation of colorless phenol compounds previously formed in the mitochondria and then dissolved in the vacuolar liquids.

Recent observations on pollen formation in certain monocotyledons, L. GUGNAARD (*Compt. Rend. Acad. Sci. [Paris]*, 161 (1915), No. 21, pp. 623-625).—Reporting further observed exceptions to the two general modes of pollen formation (*E. S. R.*, 34, p. 525), the author states that the Orchidaceæ may now be

added to the Iridaceæ, as a sufficient number of genera in the former family have been examined to create a strong presumption that the phenomenon of simultaneous quadripartition is general also for this family.

The ripening of seeds in legumes, C. SCHNEIDER (Landw. Jahrb., 48 (1915), No. 5, pp. 739-789, pl. 1, fig. 1).—It is stated that during the process of ripening of legumes, before the green color has given place to yellow but not after that stage, there is a partial transformation of materials and transfer thereof to the seeds. This results in a gain of weight to the seeds at the expense of the other portions of the plant, the nonnitrogenous constituents preceding and the nitrogenous materials following. Backward plants show differences in this respect. Different legumes show characteristic ratios as regards their various constituents. While the readiness to germinate is developed early, the germination percentage is increased during the stage of yellowing, which should be completed before gathering the crop, as early harvesting checks the process of after-ripening and lowers the germination percentage.

Parallel tests of seeds by germination and by electrical response, MARY T. FRASER (Ann. Bot. (London), 30 (1916), No. 117, pp. 131-189).—These experiments, undertaken with a view to the further development of the electrical test used by Waller (E. S. R., 13, p. 461) on the germinability of seeds looking to its possible commercial application, are said to have yielded results which were quite consistent throughout the same samples of grain germinated under given conditions. It is stated that variations in electrical response of grains under varied conditions are strikingly paralleled by variations in the germination values. A certain amount of evidence has already been obtained that there is a time of maximal electrical response, probably corresponding to the time when growth becomes established. The electrical response can be ascertained in a much shorter time than the total germinative value. It appears to be possible also to discriminate on the basis of electrical response between live seeds of high and those of low vitality.

Relations between light and germination, G. GASSNER (Ztschr. Bot., 7 (1915), No. 10, pp. 609-681, figs. 2).—This is a series of preliminary studies including the latent influence of light on germination, the influence of desiccation, the relations between light and media favoring or hindering germination, the influence of light as related to seed bed temperature and after-ripening, the effects of previous treatments, the influence of chaff and of the semipermeable seed coat in the case of *Chloris ciliata*, and coloration of seed and of medium.

Studies in electroculture, R. TRNKA, B. MYŠÍK, and Š. SÁJFERT (Věstník 5. Sjez. Čes. Lék. Pětr., 1915, p. 408; abs. in Bot. Centbl., 129 (1915), No. 17, p. 448).—It is stated that while experimentation showed an increase of crops as a result of electrical influence, especially when employed during the hours of sunlight, it has not been sufficient to warrant its practical employment.

The influence of radio-activity on dissimilation processes, V. ZBOŠNÍČEK (Věstník 5. Sjez. Čes. Lék. Pětr., 1915, p. 431; abs. in Bot. Centbl., 129 (1915), No. 15, p. 378).—It is stated that while concentrated emanations from radio-active material injure living plants, very weak ones favor starch formation. The formation of sugar is said to be possible only when sunlight is added.

Are spore-forming bacteria of any significance in soil under normal conditions? H. J. CONN (New York State Sta. Tech. Bul. 51 (1916), pp. 3-9).—The author states that the spore-forming bacteria, *Bacterium mycoides*, *B. cereus*, and *B. megatherium*, are nearly always present in soil and that they have been considered characteristic and important soil organisms. In nitrogenous culture media, these bacteria grow rapidly and cause a vigorous ammonification.

and for this reason they have been considered important ammonifiers of the soil. A series of tests was conducted to determine the significance of these organisms in the soil, 26 tests being made to ascertain their relative importance in heated and unheated soil infusions.

When the soil infusion was heated before plating to a temperature of from 75 to 85° C., nearly, if not quite, as many colonies of these bacteria developed as when plated from unheated infusions. This temperature is considered high enough to kill the vegetative forms of bacteria, and their constant occurrence in large number is believed to suggest that the bacteria are present in normal soils as spores rather than in the vegetative state. No increase in the total number of these organisms and no decrease in the number of their spores could be detected in soil to which fresh manure was added. These results are considered as casting doubt on the common assumption that these organisms are important ammonifiers in the soil and they raise a question as to what possible soil conditions favor their growth and multiplication.

A possible function of Actinomycetes in soil. H. J. CONY (*New York State Sta. Tech. Bul.* 52 (1916), pp. 3-11).—In the course of a qualitative study of the bacteria in certain New York State soils, there was recognized a great similarity between the different soils and the relative numbers of Actinomycetes and lower bacteria present, provided the soils were in the same state of cultivation. Later it was found that Actinomycetes were practically always present in greater abundance in old sod soil than in soil recently cultivated. An investigation of this subject has shown that the average ratio between the number of Actinomycetes in neighboring sod and cultivated spots of the same soil type is slightly more than 2:1. In a study of three neighboring spots in a single soil type, it was found that Actinomycetes colonies not only appeared in greater numbers from sod than from cultivated soil but also appeared in greater numbers from old sod than from sod only two or three years old. The reason for this difference in numbers has not been learned, but it is suggested that Actinomycetes are active in the decomposition of grass roots.

The number of colonies allowable on satisfactory agar plates. R. S. BREED and W. D. DOTTERER (*New York State Sta. Tech. Bul.* 53 (1916), pp. 3-11).—Attention is called to the importance in making bacteriological counts of the limit in the number of colonies that may be allowed to grow on a plate without introducing serious errors, and the authors present the results of an investigation testing the standard methods for bacterial milk analysis as adopted by the American Public Health Association and as modified in its meeting of 15 (E. S. R., 35, p. 70).

The work reported includes a study of the counts made for a large number of agar plates incubated for five days at 21° C., and of some of the same plates for two days' additional incubation at 37°. The results obtained indicate that for milk analysis counts made from plates having more than 30 and less than 400 colonies are very nearly as satisfactory as those made from plates having more than 40 and less than 200 colonies.

A comparison between agar and gelatin as media for the plate method of counting bacteria. H. J. CONY and W. D. DOTTERER (*New York State Sta. Tech. Bul.* 53 (1916), pp. 12-15).—A comparison has been made between the counts obtained from 641 agar plates and 599 gelatin plates inoculated with various samples of soil, and the results show that the discrepant counts are as likely to occur with one medium as with the other. The remarkable agreement between the two media is believed to indicate that the nature of the medium used has little or no influence in producing the occasional widely discrepant counts which occur.

FIELD CROPS.

[Experiments with field crops], A. M. McOMIE (*Arizona Sta. Rpt. 1915, pp. 518-528, figs. 4*).—Of 13 varieties planted as spring wheat, California Club produced the largest yield, 38 bu., and Turkey Red the lowest, 14.5 bu. per acre. Club and Early Baart yielded each 36 bu. per acre and Blue Stem 35.3 bu. Red Chaff ranked first with 55 bu. per acre among 15 varieties sown the latter part of October, being followed by Blue Stem with 53.9, Turkey Red with 51, and Kofoid with 50 bu. per acre. In this list of varieties, Marquis produced 47.8, Early Baart 47.8, Red Fife 47.5, and Red Russian 47.3 bu. In every case fall-sown wheat outyielded the spring-sown and was also less subject to rust.

Sixty-day and Texas Red oats also gave better yields from fall than from spring planting. Black Egar is described as a variety with black, oval, large and heavy seed, an exceptionally long panicle, wide coarse leaves, and heavy, cannelike stems, and as maturing readily at an elevation of 7,000 ft., when the growing season is very short.

Utah Winter, C. I. No. 592, produced the heaviest yield of 10 varieties of spring-sown barley, being followed by Mariout and Blue Hull-less. Black White emmer and spelt, both fall sown, yielded 3,630 and 2,970 lbs. per acre respectively.

Of 25 varieties of corn under test, Sacaton Mexican June led in yield with 99 bu. per acre. Mexican White Flint and White Dent each yielded 85 bu., while some of the varieties fell as low as 10 bu.

The results of tests with Sudan grass showed that this crop is capable of maintaining 20 sheep per acre continuously for 100 days. In a comparison with Club Top, Sumac, and Amber cane for forage, Sudan grass gave a yield of 16,920 lbs. of dry hay and Club Top, the best of the other three varieties, 14,000 lbs. per acre. The leading grain-producing sorghums for the year were Shaluu, Dwarf Black Hulled White Kafir corn, Yellow milo maize, and White milo maize.

Winter vetch gave a dry product of 13,400 lbs. and spring vetch of 16,750 lbs. per acre. A yield of 24 tons of sugar beets per acre is recorded for a planting made November 14, as compared with nearly 8 tons for a planting made February 9. The November plantings consistently exceeded the February plantings for the last four years. A yield of a little over 2,000 lbs. of sugar-beet seed is reported. Twelve varieties of flax ranged in yield from 83.5 to 36.5 bu. per acre. The leading variety of millet was Kursk.

The best success with winter grains of any so far experienced at the Snowflake dry farm was obtained the past year, the yields ranging from 12 to 32 bu. per acre, with Turkey Red and Marquis leading in production. A yield of about 1,100 lbs. of seed per acre was secured from the Topary bean, while Pink and Boetcher also gave good yields.

At the Sulphur Spring Valley dry farm October seeding of small grains gave better yields than later seeding. Marquis wheat produced the largest yield, 19.8 bu. per acre, while Turkey Red, Red Chaff, Early Baart, and California Club also proved satisfactory. Barley and rye were found valuable as winter pasture crops, and both produced grains after being pastured. Spring varieties of grain seeded March 15 practically failed. Notes are given on the production of crops on shallow soil underlain with caliche and on deep soils with clay and a porous or soft caliche subsoil.

The crops succeeding best at this farm during the past two years were Kafir corn, Shaluu, Club Top, and other saccharin sorghums; Whippoorwill cowpeas; Sudan grass; and Mexican June, White Wonder, Sherrod, Freid, White Flint

and Diamond Joe corn. These crops succeeded best when planted from April 1 to May 15.

Notes are given on the production of beans, corn, wheat, emmer, and potatoes at the Prescott dry farm. The leading varieties of beans were Colorado Pinto, Bates, Boecher, and Tepary, mentioned in decreasing order of yield. Sudan grass produced 3.5 tons of dry hay per acre from two cuttings, in addition to a pasture crop. On bottom land a yield of 3 tons was secured from the first cutting and 2½ tons from the second, but there was no pasture crop. These plots were planted in rows 42 in. apart. Sudan grass sown with a grain drill failed to reach a height sufficient for cutting. A yield of 3 tons per acre of this grass is also recorded for the high plateau sections, where it was grown at an elevation of about 7,000 ft.

[Breeding work with field crops], G. F. FREEMAN and J. C. T. UPHOF (*Arizona Sta. Rpt. 1915*, pp. 533-538, fig. 1).—In variety tests with alfalfa at Yuma the hairy type of Peruvian gave the best yields. From the cutting made March 23, 1915, this type of alfalfa produced 5,500 lbs. of hay per acre as compared with 4,738 lbs., the average of the other varieties in the test. The corresponding figures for the cutting made December 8, 1915, were 2,217 and 1,701 lbs., respectively.

An average yield per acre of 1,810 lbs. of green beans was secured from 17 pure races of Tepary beans grown at the Yuma date orchard, the highest yield being 2,526 lbs. for race No. 48. Fifteen lbs. of wild Tepary seed was planted in field plots at Yuma for comparison with the domesticated form as a hay crop. On one plot this seed yielded at the rate of 5,080 lbs. of air-dry hay per acre and on another at the rate of 6,180 lbs. In this test pure race No. 17 yielded 9,760, 6,795, and 5,882 lbs. and Whippoorwill cowpeas 5,900 lbs. per acre of air-dry hay.

A yield of cleaned wheat of 42.91 bu. per acre was secured at this point. As compared with the yield in 1914 this was an increase of 5.24 bu. per acre, which is thought probably due to turning under a few weeks before seeding the wheat in the fall a green manure crop of Tepary beans yielding approximately 15,000 lbs. of green material per acre. In a test of varieties Turkey Red yielded at the rate of 57 bu. per acre, but the averages for all the old plots were as follows: Sonora 51.7, White Algerian Macaroni 44.6, Red Algerian Macaroni 44.6, Early Baart 43.3, and Turkey Red 43.2 bu. per acre.

Among 63 pedigree increase plots from the selection of the best head rows of the preceding year the White Algerian Macaroni strains gave an average of 14 bu. per acre more than the average for the other strains. It was observed in connection with this work that certain strains of Turkey wheat, all of which were hard when grown in the Central Plains States, immediately became soft when grown in Arizona under irrigation, while other strains from the same original sources have remained hard. It was also found that on the average those strains becoming soft immediately were greater yielders than those which resisted the softening effect of the climate, but a few pure races of hard Turkey wheat were found which were high yielders and at the same time maintained their hard, glutenous texture.

[Report of the agronomy department, C. A. SAHR (*Hawaii Sta. Rpt. 1915*, pp. 29-44, pls. 2).—Deep plowing of soil and allowing it to aerate from one to several months before planting rice and taro gave increased yields in every test, although in the case of taro the increase was small. Potatoes on soil with 28 per cent of water in the upper 6 in. failed to sprout properly, while soil with 24 per cent of moisture produced plants. In a spraying test the check plot yielded 15 bu., the plot sprayed with lime-sulphur 25.9 bu., and the one sprayed with Bordeaux mixture 30.2 bu. of tubers per acre.

Notes are given on culture tests with clover, sweet clover, *Crotalaria mesopotamica*, *C. madurensis*, *C. incana*, *C. striata*, *Stizolobium hasskianum*, *S. cinereum*, and *S. capitatum*. Jack beans and species of velvet beans sown early in September gave the best yields of both green substance and seed. The following annual yields of green forage from different varieties of alfalfa are reported: Spanish 50,362 lbs., Kansas common 52,065 lbs., Utah common 45,245 lbs., Peruvian 35,530 lbs., and Turkestan 30,595 lbs. per acre. Semipalatinsk alfalfa (*Medicago falcata*) did not prove equal to common alfalfa or Japan clover (*Lespedeza striata*).

The total yields of green forage per acre for a period of 26.5 months for the sorghums and 27 months for the Japanese cane are recorded as follows: Sweet sorghum, 8 cuttings, 86.55 tons; nonsaccharin sorghum, 6 cuttings, 82.45 tons; and Japanese cane, 3 cuttings, 157.64 tons per acre. The results with other varieties of sorghum are also noted.

Of the several forage grasses on trial, Sudan grass retained its lead in the production of green forage, yielding at a low elevation an average of 14.5 tons per cutting per acre for 7 cuttings as compared with an average of a little less than 4 tons per acre for 6 cuttings for Tunis grass. The value of other grasses, including molasses, Wilder, Australian blue, Giant Bermuda, Jeff, Mitchell, wallaby, side oat grama, Judd, and American buffalo grass, is briefly mentioned. Japanese millet is reported as maturing at the station in 80 to 100 days under ordinary conditions and as yielding about 10 tons of forage per acre when cut green and 3 tons of roughage and 30 bu. of seed per acre when left to mature. The best results in controlling the spread of Japanese rice grass were secured by spraying with arsenite of soda.

Japanese buckwheat was found to mature a week earlier than Silverhill and to yield about 25 per cent more grain. The average annual yield per tree for 4 years of Carayonica cotton planted on the station grounds in February, 1909, was approximately 1 lb. of lint. The distribution of seed of cotton and grasses conducted by the department is briefly mentioned.

[Work with field crops in 1915] (*Wisconsin Sta. Bul.* 268 (1916), pp. 4-6, 10-15, 32, 36, figs. 16).—In connection with the work of the agronomy department with pedigreed strains of rye, an improved strain known as Pedigree No. 1, and excelling in stiffness of straw and milling qualities, was developed from the Schlansted variety. A yield of 46.5 bu. per acre under field trials, or 14.5 bu. over the yield of common varieties, is recorded. A cross by E. J. Delwiche between Minnesota 169 and Red Fife wheat produced a strain with exceptional stooling power, marked resistance to rust, a strong straw, and early maturing qualities. In 30 tests at the station by R. A. Moore and R. B. Leith with wheat, Pedigree No. 2, a type of Turkey Red winter wheat, yielded 49.6 bu. per acre and Marquis spring wheat 43 bu. Milling and baking tests with 21 samples of the 1914 crop showed that Pedigree No. 2 gave fully as good results as the standard spring wheats of highest milling quality. The Wisconsin spring wheats analyzed 12.46 per cent of gluten as compared with 11.95 in the standard spring wheat patent flours.

The work of the station to establish leup growing in the State, continued by C. P. Norgard, is described and the progress made in this direction is noted. The results of comparative trials of over 200 strains and varieties of alfalfa by L. F. Graber indicated that the common purple-flowered alfalfa from Kansas and Nebraska seed withstood winterkilling last winter quite as well as alfalfa from northern-grown seed. Pedigree No. 4 and White Jewel oats grown in the Superior district were found by E. J. Delwiche to be the most resistant to the influences causing lodging. Yields of 2.5 to 3.7 tons of hay per acre are reported.

as secured in plat tests although the season was unfavorable on account of prevailing low temperatures.

Studies made of the influence of freshly turned under green manures like clover on the germination of seeds rich in oil indicated that germination is injuriously affected by a soil fungus, *Rhizoctonia*, which is given most favorable conditions of growth through the incorporation of organic matter.

Investigations on the relation of sulphur to plant nutrition were extended to oats and barley which were materially helped, especially in seed production, by an increased supply of sulphates, but the effect was not so marked as with rape and clover. The influence of elemental sulphur, while sometimes beneficial, was found often to exert a poisonous effect.

Relative water requirement of corn and the sorghums. E. C. MILLER (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 13, pp. 473-484, pls. 3, fig. 1).—In work carried on by the Kansas Experiment Station, the water requirement was determined for four varieties of corn and two varieties of sorghum in 1914, and for three varieties of corn and five varieties of sorghum in 1915. The work was carried on at Garden City, Kans., where the plants were grown in large, sealed, galvanized-iron cans containing approximately 110 kg. of soil, having a wilting coefficient of 13 and a moisture content maintained at from 20 to 21 per cent on the dry basis. Three plants of corn were grown in each can during both seasons, and 6 sorghum plants were grown in each can in 1914, but only 3 in 1915. A summary of the data secured in the experiments, which are tabulated in detail, shows the following relative standing as to water requirement of the different crops and varieties for the two years: In 1914, Blackhull Kafir corn 1, Dwarf Milo maize 1.04, hybrid corn 1.09, Sherrods White Dent corn 1.22, and Pride of Saline corn 1.24; in 1915, Blackhull Kafir corn 1, Dwarf Blackhull Kafir corn 1.02, Dwarf Milo maize 1.12, feterita 1.14, hybrid corn 1.17, Pride of Saline 1.23, Sherrods White Dent corn 1.27, and Sudan grass 1.41.

Sorghum and millet. F. A. WELTON (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 6, pp. 168-174, figs. 2).—This article discusses briefly the culture and value of sorghum and millet, and reports the yields secured in comparative tests with these crops.

A comparison of corn and sorghum during the four years beginning with 1912 showed that such late varieties of corn as Blue Ridge, Hickory King, and Boone County White produced larger yields of green forage per acre than were obtained from sorghum, while two early varieties, Darke County Mammoth and Learning, yielded less than sorghum. For the same period average yields of 10.14, 9.1, 9.9, and 7.6 tons of green forage per acre are reported for Amber sorghum, Orange sorghum, Red Kafir corn, White Kafir corn, and Yellow milo maize, respectively. The average production for seven nonconsecutive years of Hungarian, German, Red Siberian, and Japan barnyard millet tested on the station farm was 2.6, 4.4, 2.8, and 4.8 tons of dry forage per acre, respectively.

Concerning the growth and composition of clover and sorrel (*Rumex acetosella*) as influenced by varied amounts of limestone. J. W. WHITE (*Pennsylvania Sta. Rpt. 1914*, pp. 46-64, pls. 13).—Studies on the general fertilizer plats of the station, supplemented by pot experiments, were made with reference to the growth of sorrel as influenced by soil acidity. Work related to this subject by other investigators is briefly reviewed and the results presented in tabular form are discussed. Some of the plats on which the investigation was conducted received ammonium sulphate as the source of nitrogen and showed an increasing tendency to failure of clover and to a less extent of corn and wheat.

In 1912-13 sorrel grew on plat 32 having an acid soil at the rate of 1 ton per acre. In areas where the soil acidity required from 3,500 to 3,800 lbs. of

calcium carbonate per acre to correct it to the depth of 7 in., clover failed and sorrel took its place; where from 4,000 to 4,500 lbs. of calcium carbonate were similarly required, timothy was largely replaced by sorrel; and where the maximum acidity was reached red top predominated. Plots receiving calcium as sulphate and carbonate are reported as free from sorrel.

In the pot experiments the greatest yield of clover occurred where limestone was applied at the rate of 3 tons per acre in excess of the quantity required to render the soil neutral. Clover failed in these tests where the acidity for its correction required from 3,000 to 3,500 lbs. of calcium carbonate per acre for the upper 7 in. of soil. Where limestone was present in slight excess in the pot experiments, sorrel was largely replaced by clover, but it produced the highest yield where the maximum amount of limestone was applied.

The calcium content of clover and sorrel was highest where the largest quantity of limestone was added to the soil. The protein content of clover was found to vary but slightly whether grown in an alkaline or an acid soil. The calcium content of sorrel grown on plot 32 was determined as only 10 per cent of that grown in an alkaline soil. The leaves of sorrel grown on this plot contained 17.92 per cent protein, equivalent in amount to that in clover, and the sorrel contained per ton of dry matter the equivalent of \$9.03 in nitrogen, potassium, and phosphorus as compared with the corresponding value of \$19.95 for clover. The water-soluble acidity of the sorrel from this plot calculated to oxalic acid was found to be as follows: Total plant 1.36 per cent, leaves 2.45 per cent, stem 0.969 per cent, and seed 0.44 per cent, as compared with 0.98 per cent in the whole plant grown on alkaline soil.

On the basis of these results the author concludes that sorrel is not an acid-loving plant but has the property of adaptation under soil conditions unfavorable to the growth of most field crops.

Winter injury of alfalfa and clover. C. A. GEARHART (*Mo. Bul. Ohio Sta. 1 (1916), No. 7, pp. 199-291*).—Data collected in 64 per cent of the counties of the State are reported as showing that 22.7 per cent of the red clover, 23.3 per cent of the mammoth clover, 17.3 per cent of the alsike clover, and 44 per cent of the alfalfa winterkilled during the winter of 1915-16. Grimm alfalfa was found to show no greater resistance to winter conditions than common alfalfa from seed produced in the Northwestern States.

Comparative yields of hay from several varieties and strains of alfalfa at Brookings, Highmore, Cottonwood, and Eureka. A. N. HUME and M. CHASE LIX (*South Dakota Sta. Bul. 163 (1916), pp. 282-343, figs. 9*).—Historical and descriptive notes are given of a number of varieties and strains of alfalfa and other species of *Medicago* introduced and tested in South Dakota. Results are reported of comparative trials of several varieties and strains of alfalfa made at Brookings, Highmore, Cottonwood, and Eureka.

The average yield of field-cured hay per acre in the four localities for the three years, 1913 to 1915, was 2,565 lbs. for Vale, 2,532 lbs. for Grimm, and 2,527 lbs. for Turkestan alfalfa. It is not implied that these three strains should be produced to the exclusion of all others, but it is advised that seed strains as Baltic S. D. No. 167, Common S. D. No. 12, Kansas Nonirrigated S. I. No. 173, and other strains now successfully grown in the State should not be hastily discarded. Attention is called to the fact that although Turkestan alfalfa is adapted to hay production in South Dakota, the seed of the variety has a much more limited market outside of the State than the seed of other strains. Field trials of strains of *Medicago falcata* made at Brookings are reported as indicating that the species may not yield as large average amount of hay as the strains of *M. sativa* which have been tested.

Correlated characters in maize breeding, G. N. COLLINS (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 12, pp. 435-454, pls. 9).—This article reports the results of a study undertaken "to determine whether the difficulty in recognizing types of maize is due to a lack of familiarity with the plants or whether there is a fundamental difference between the heredity of maize and that, for example, of cotton." It was thought that the difficulty of recognizing types among maize plants might be due to a lack of sufficient discrimination and that correlations were the rule rather than the exception. The data obtained were afforded by a cross between Waxy Chinese and Esperanza, Chinese and Mexican varieties respectively, with a number of definitely contrasted characters and considered completely isolated from very remote times. Tables are given showing the mean of different characters and the coefficient of variation of characters in first and second generation plants, correlation coefficients, and character pairs exhibiting genetic correlations. The following characters are discussed: Hairs on the leaf sheath, tassel characters, tassel exert, number of erect leaf blades, angle of tassel axis, and one-sidedness or the peculiarity that a number of the upper leaf blades are borne on one side of the plant.

The results are reported as showing that the characters studied, instead of forming coherent groups, are almost completely independent in inheritance. For the purpose of distinguishing different kinds of correlations they are classified as physical, physiological, and genetic, and a method is proposed by which physiological and genetic correlations may be distinguished.

For the study of correlations 11 of the characters most definitely contrasted in the parents were selected and the correlation coefficients of all the combinations were calculated. Of the 55 possible combinations, 20 were found to exhibit significant correlations, but in all but 5 of these correlations are believed to be physiological rather than genetic. No correlation was found between any two characters closer than 0.5, which fact is regarded as offering an explanation of the difficulty of recognizing types in maize.

"This lack of coherence of characters in maize, taken with the fact that to maintain a satisfactory degree of vigor a diversified ancestry must be maintained, would appear to make the method of isolating types inapplicable to this plant. As an offset to the limitation thus imposed, advantage may be taken of the facility with which desirable characters derived from different parents can be combined."

Cooperative fertilizer experiments with corn, 1908-1914, G. S. FRAPS (*Texas Sta. Bul.* 184 (1916), pp. 3-64).—The results secured during the first three years have been previously reported (*E. S. R.*, 25, p. 627). This bulletin deals mainly with the experiments carried on from 1911 to 1914. Tables are given showing the results secured by the different cooperators and the composition of the soils on which the tests were made. The details of each test are briefly noted and the effect of the different fertilizers or fertilizer ingredients is discussed.

During the seven years, 114 experiments were made and in 87 of this number a gain was secured from acid phosphate, in 76 from cotton-seed meal, and in 46 from potash. It is concluded from the data that the soils concerned need phosphoric acid first, nitrogen next, and potash least. Using from 150 to 200 lbs. of acid phosphate the average gain produced was from 5 to 7 bu. of corn per acre. From 30 to 100 lbs of cotton-seed meal, there was an average gain of 0.4 to 3.8 bu., when used in combination with acid phosphate, while with 200 lbs. of cotton-seed meal, alone or with acid phosphate, there was from 5.5 to 7.1 bu. increase, the results being based on only those experiments in which a gain occurred. From 5 to 25 lbs. of muriate of potash per acre, there were produced

average gains of from 2.3 to 3.2 bu. of corn, and with 50 lbs. of muriate of potash, from 2.1 to 3.1 bu. The average gain ascribed to barnyard manure was from 8.3 to 11.5 bu. per acre, or larger than the gains from acid phosphate, cotton-seed meal, or potash salt.

Thomas phosphate used in 12 tests had about 60 per cent of the effectiveness of acid phosphate. In 11 experiments the phosphoric acid of rock phosphate showed about 22 per cent of the effect of the phosphoric acid of acid phosphate. With lime, used in 12 experiments, there was an average gain of 4.5 bu., but no gain in one-half of the tests. When 50 lbs. of nitrate of soda was substituted for 100 lbs. of cotton-seed meal in 49 experiments, the average difference in favor of cotton-seed meal was about 1 bu. of corn per acre. Manure gave profitable results in the greatest number of tests. Acid phosphate alone gave a large number of profitable increases, and cotton-seed meal alone gave nearly the same number. Cotton-seed meal with acid phosphate gave profitable results in 4 per cent of the trials.

Tests of soy beans, 1915. E. H. JENKINS, J. P. STREET, and C. D. HUBBELL (*Connecticut State Sta. Bul. 191 (1916), pp. 14, fig. 1*).—This bulletin presents the data gathered in 1915 in continuation of earlier work (*E. S. R.*, 32, p. 633).

Twenty unnamed varieties of soy beans, chiefly new introductions grown in cooperation with the U. S. Department of Agriculture, ranged from 97 to over 150 days in period of growth and from 19.3 to 31.2 bu. of seed per acre in yield. The named varieties tested required from 6 to 15 days longer to mature, produced on the average 1,200 lbs. less of dry forage per acre, and the dry feed contained about 1.1 per cent more protein, as compared with the results of the same varieties in 1914.

The range in yield per acre of 18 varieties grown in 1915 was from 5,671 to 22,477 lbs. of green forage and from 12.5 to 29 bu. of seed. The results of two years' tests of those varieties which grew successfully in both years are reported as indicating that Wilson, Ebony, and Cloud, small, black-seeded varieties, were in both years among the six varieties yielding the most dry matter in the green forage. Tables are given showing the yield and composition of soy-bean forage, alfalfa, and ensilage corn as determined at the station, and the nutrients per ton of ensilage corn, soy-bean forage, and mixtures of the two. It is stated that an average crop of soy beans such as was grown by the station the past two years contains, exclusive of the roots, approximately 4,255 lbs. of organic matter, 11 lbs. of nitrogen, 23 lbs. of phosphoric acid, and 93 lbs. of potash per acre.

Results of field tests by farmers are briefly noted, and an outline is given of a paper on soy beans as a food for diabetics, previously noted (*E. S. R.*, p. 311).

Tobacco experiments, 1913. W. F. REAR, O. OLSON, and H. R. KRAYBILL (*Pennsylvania Sta. Rpt. 1914 pp. 347-374, pls. 12*).—The experiments here described were conducted in cooperation with the U. S. Department of Agriculture, with tobacco growers' societies in Lancaster, Clinton, and York counties in Pennsylvania. Experiments in Lancaster County were conducted to determine the most productive strain of the Connecticut Seedleaf or Broadleaf variety. The selection of strains by elimination based on earlier results was reduced to 10 in number. The object of the work in Clinton County was the determination of the type of tobacco best adapted to the soil and climate of the Clinton-Lowell tobacco region. The experiments in York County were inaugurated during the year to ascertain the cause of the decrease in burning quality of the tobacco grown. Earlier and similar work with tobacco has been previously noted (*E. S. R.*, 34, p. 142). Meteorological data and notes on crop conditions, together with results bearing on yield, plant measurement, and leaf quality, are presented in tables.

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In the strain selection work with Connecticut Seedleaf or Broadleaf tobacco in Lancaster County, the yields of the different filler strains were as follows: Slaughter, F 1, 1,910 lbs., Cooper, K 1, 1,910 lbs., Espenshade, N 1, 1,795 lbs., "Weaver," R 100, 1,738 lbs., Hershey, K 1, 1,719 lbs., Hostetter, D 1, 1,700 lbs., Ober, J 1, 1,643 lbs., Hoover, A 200, 1,624 lbs., Pound, H 100, 1,604 lbs., and Burkholder, A 300, 1,413 lbs. per acre. The results of plant measurements showed that the leaf dimensions presented no close relationship between the leaf expanse and the relative weights of the cured topped plants.

In an experiment on planting distance and topping height for cigar tobacco, plants were placed 28 in. apart in the row in rows 42 in. apart, and 28 in. apart in the row in rows 36 in. apart. The plants were topped at 15 to 17 or 18 leaves for high topping and at 11 to 14 leaves for low topping. Cultivation was continued in each case beyond the stage of leaf spread when it is usually discontinued in practice. In considering the results of the three previous years with those of 1913, it appeared that in all seasons high topping resulted in the highest gross yield, in two seasons high topping and close planting gave a distinctly greater yield, while in the other two seasons the wider planting gave a slightly higher return. Low topping and close planting led to distinctly higher yields in three out of the four seasons. The close planted tobacco in 1913 produced 10.6 per cent of seconds as compared with 8.6 per cent for the wider or normal planting. Of the normal planted tobacco 75 per cent by weight of the leaves were from 22 to 26 in. in length, and of the close planted tobacco only 66 per cent. The high topped plants showed 69 per cent by weight of long leaves shown as firsts, and the low topped, 73 per cent. The results for similar spacing and topping tests made in 1913 on a sandy, loam soil in Clinton County are tabulated without conclusions.

Fertilizer experiments were conducted with the Slaughter strain of seedleaf tobacco. Two plats were fertilized with manure alone at the rate of 10 tons per acre, and two with the same application of manure supplemented with acid phosphate and sulphate of potash at the rate of 300 lbs. and 100 lbs. per acre, respectively, in addition. The average yield of the plats treated with manure, a phosphate, and sulphate of potash was 1,355 lbs. per acre, and the average 4d for the plats treated with manure alone, 1,655 lbs.

Several different types of tobacco were grown for a number of years to study the effect of environmental conditions in Lancaster County on their characteristics. The results are reported as showing that the various strains retained their characteristic points of distinction.

Tests in Clinton County on different farms with wrapper and binder strains in 1913 resulted in the following yields: Local Havana 1,605 lbs., Wisconsin Havana 1,497 lbs., Connecticut Broadleaf 1,477 lbs., Local Havana 1,410 lbs., Local Havana 1,395 lbs., Local Havana 1,347 lbs., Connecticut Havana 1,260 lbs., and Local Havana 1,200 lbs. per acre. In tests with other wrapper varieties it was found that seed from shade-grown Cuban planted in the open produced leaves too short and heavy for wrapper purposes. The yields secured in this case were as follows: Halliday Havana, primed, 1,912 lbs., Halliday Havana, 1,425 lbs., Connecticut Havana 1,294 lbs., and Shade-grown Cuban (seed from Connecticut) 750 lbs. per acre.

The influence of suckering upon the yield and quality of tobacco. H. R. JENNETT, (*Pennsylvania Sta. Rpt. 1914, pp. 374, 375*).—An experiment was made on two plats to demonstrate the value of suckering tobacco. A difference of 330 lbs. of cured leaf per acre in favor of the suckered plants was secured with a difference in quality in favor of suckering even greater than the difference in yield.

Influence of time of topping upon distance between leaves on the stalk. H. R. KRAYBILL (*Pennsylvania Sta. Rpt. 1914, pp. 375-377*).—Observations were made in 1913 upon 64 plants of the Slaughter strain of Pennsylvania Broadleaf similar in size, uniformity, and vigor. Sixteen plants were topped as soon as the first bud was visible, 16 at the stage of development half-way between the time when the first bud had appeared and the time when the first blossom appeared, 16 when the first flower appeared, and 16 were allowed to mature seed. All topped plants were topped to 15 good leaves.

The data presented in tables indicate that the stem continues to elongate even after the first flower appears but that the portion bearing the eighth to the fifteenth leaf makes the greater increase in length. From the time the first bud appeared both portions of the stem seemed to elongate, the portion bearing the first to the eighth leaf making the slightly larger increase. Topping appeared to arrest growth, affecting to the greatest extent the portion bearing the eighth to the fifteenth leaf. A distinct increase in the length of the internodes was observed after the time the first bud appeared, the average increase between neighboring leaves of the first to the eighth leaf being 0.183 in. or 20.8 per cent. and of the eighth to the fifteenth leaf 0.13 in. or 10.4 per cent.

White Burley tobacco, I. S. COOK and C. H. SCHERFFIUS (*West Virginia Sta. Bul. 152 (1916), pp. 3-20, figs. 6*).—Cultural directions, including soil selection and preparation, rotations, transplanting, cultivation, topping, selection of seed plants, harvesting, curing, stripping, and grading are given, and the results of variety and fertilizer tests are reported. The work is in cooperation with the U. S. Department of Agriculture.

Introduced varieties of White Curley grown from selected seed gave promise of proving superior to the standard variety grown in the State. The results of several fertilizer tests indicated that nitrogen influences the yields of tobacco in the State more than does either potash or phosphoric acid. A combination of all three plant food constituents produced the highest average yield, and an application of about 700 lbs. of a high-grade fertilizer containing not less than 4 per cent of nitrogen was found profitable. In one test conducted for two years the use of 10 tons of barnyard manure per acre gave the best results of all fertilizer materials applied. The approximate cost of growing an acre of tobacco, including the use of 1 ton of ground limestone, 200 lbs. each of sodium nitrate and potassium sulphate, and 300 lbs. of acid phosphate was determined as itemized at \$66.50.

Tobacco growing in Canada, F. CHARLAN (*Canada Dept. Agr. Bul. 25. 2. ser., pp. 29, figs. 8*).—This bulletin discusses in a popular manner the different phases of tobacco culture, such as the selection and preparation of the soil, the use of hotbeds, cultural methods, harvesting, curing, fermentation, and marketing.

Wheat experiments, C. G. WILLIAMS (*Ohio Sta. Bul. 298 (1916), pp. 447-484, figs. 19*).—This bulletin reports the results of experiments with wheat covering the period from 1887 to 1915, most of the work having been done the last 15 years. The experiments included soil treatment, methods of seedling, tests of varieties, variety improvement by means of pure line selection, and milling and baking tests. Most of the work was done on the station farm at Wooster, but results secured at Columbus, at the district experiment farms at Strongsville, Germantown, Carpenter, and Findlay, and at the county experiment farms in Paulding, Miami, Hamilton, and Clermont counties are also reported.

Wheat without fertilizer treatment in a 5-year rotation with corn, oats, clover, and timothy averaged 42 per cent higher in yield, and in a 3-year rotation with corn and potatoes 50 per cent higher than wheat receiving no fertilizers in

continuous culture. As compared with corn, wheat declined less in yield when grown continuously without fertilizers, and as compared with corn and potatoes in 3-year rotations without fertilizers showed greater hardness and persistence.

In fertilizer experiments 14 per cent acid phosphate was used at the rate of 160 lbs. per acre on wheat and 320 lbs. per rotation at Wooster and Strongsville and of 120 lbs. on wheat and 240 lbs. per rotation at Germantown and Carpenter. Muriate of potash was applied at the rate of 100 lbs. per acre on wheat and 200 lbs. per rotation at Wooster and Strongsville and 20 lbs. per acre on wheat and 40 lbs. per rotation at Germantown and Carpenter. Nitrate of soda and dried blood were given at the rate of 120 lbs. and 50 lbs. per acre, respectively, on wheat, an equivalent of 480 lbs. of nitrate of soda per rotation at Wooster and Strongsville and at the rate of 80 lbs. on wheat and 160 lbs. per rotation at Germantown and Carpenter. Barnyard manure was applied at the rate of 4 tons per acre on wheat and of 8 tons per rotation at Wooster and Strongsville and of 5 tons per acre at Germantown and Carpenter. In arriving at the financial results, corn was valued at 50 cts. per bu., oats at 33½ cts., wheat at 90 cts., hay at \$10 per ton, corn stover at \$1, and straw at \$2. The acid phosphate was valued at \$14 per ton, muriate of potash at \$50, and nitrate of soda at \$60. The extra cost of harvesting the increase of crops was placed at 10 cts. per bu. for cereals and \$1 per ton for hay. In the fertilizer tests at Wooster, Strongsville, Germantown, and Carpenter the use of phosphorus alone increased the yield of wheat from 4.85 to 8 bu. per acre, phosphorus and potassium from 6.2 to 9.19 bu., and phosphorus, potassium, and nitrogen from 8.77 to 16.2 bu. Based on all the crops of the rotation and taking into account the fertilizer cost and the expense of harvesting the increase, the average annual net value per acre of the increase from the use of phosphorus at the four points was \$2.87, from phosphorus and potassium, \$3.21; and from phosphorus, potassium, and nitrogen, \$2.60. The cost of the nitrogen in commercial forms did not justify its use in the growing of cereals. In these experiments manure gave a return of more than \$3 per ton without proper reinforcement with phosphorus, while in other experiments at the station a return of more than \$4 per ton has been secured.

The use of 1 ton of burnt lime or 2 tons of ground limestone per acre once in five years on the acid soil at Wooster increased the yield of wheat 2.11 bu. per acre as a 10-year average. The lime increased the value of all crops in rotation from \$6.17 to \$27.41 per acre, depending upon the fertilizer treatment. The average gain for lime per rotation was \$16.47 per acre. No treatment of the soil with fertilizers or manure rendered lime unnecessary.

Plowing 15 in. deep showed a gain of 0.43 bu. per acre over plowing 7.5 in. deep, and ordinary plowing with subsoiling showed a gain of 1.04 bu. of wheat over ordinary plowing alone. Neither deep plowing nor subsoiling proved profitable on the Wooster silt loam soil.

The results from broadcasting and drilling seed varied widely with the season. As an average of five seasons the gain for drilling was 3.8 bu. per acre. No difference in yield was found between drilling 1 in. and 2 in. deep, and a 3-in. depth showed but a slight decline. As an average of three tests with the same quantity of seed per acre, cross-drilling gave an average gain of 0.76 bu. of wheat per acre over drilling one way.

The results of making nine different seedings of wheat at intervals of one week, beginning September 1 and ending October 26, for a period of 14 years, were in favor of the seedlings made September 21 and 22, with the seedlings on September 28 and 29 standing next, and those of September 14 and 15 third. The results of experiments on the use of from 3 to 10 pk. of seed per acre and

extending over a period of 17 years with 10 different varieties showed that 8 pk. per acre proved most profitable, the use of 9 pk. standing second, and of 6 pk. third.

No important differences in yield were found in comparing heavy kernels of seed wheat with light kernels with such variations in weight as can be secured with the ordinary fanning mill. With hand-selected seed of pure line strains with variations in weight of 100 per cent or more, important increases in yield were obtained from the heavy kernels.

Of the varieties tested for 18 years the following, mentioned in decreasing order of yield, gave the best results: Dawson Golden Chaff, Nigger, Poole, Gipsy, Valley, Harvest King, Mealy, Gold Coin, Hickman, and Nixon. Dawson Golden Chaff, Mealy, and Gold Coin are reported as of inferior milling and baking quality. Variety tests conducted the last eight years and including five of the newer varieties not in the trial above mentioned showed Portage, Dawson Golden Chaff, Gold Coin, Gladden, Trumbull, Early Red Clawson, Harvest King, Red Wave, Hickman, and Poole, given in decreasing order, to have been the highest yielders. New varieties recommended to be seeded at the rate of 1 pk. per acre were found to require as heavy seeding as the old standard varieties.

In following the pure line method of selection decided differences in winter resistance, stiffness of straw, yield of grain, and breadmaking qualities are reported to have been found in the progeny of individual heads selected from ordinary varieties of wheat.

Some lessons from the wheat crop of 1915, C. E. THORNE (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 7, pp. 215-217).—Land growing wheat continuously without fertilization since 1894 yielded 10 bu. per acre in 1915, this being the largest yield in 12 years. The average production without fertilizers for the 22 years was raised to 7.5 bu. per acre. An annual dressing of 5 tons of barnyard manure per acre increased the yield to 23.8 bu. for 1915, and to 18 bu. for the 22 years, and 430 lbs. of complete fertilizer raised the yields to 22.6 bu. and 19.3 bu., respectively.

Wheat without fertilizer treatment grown in a 3-year rotation with corn and clover since 1898 yielded 17.3 bu. in 1915, and an average of 11.9 bu. for the 18 years. Where only the corn in this 3-year rotation received 8 tons of barnyard manure per acre, the yield of wheat in 1915 was 24 bu., the 18-year average being 20.7 bu. Manure applied at this rate but dusted with 40 lbs. of acid phosphate per ton gave a yield of 29.8 bu. per acre in 1915 and an average of 26.6 bu. for the 18 years.

In another 3-year rotation including clover and begun in 1894, wheat followed potatoes. In this test the unfertilized wheat yielded 33.7 bu. per acre in 1915, and averaged 26 bu. for the 21 years. Where both potatoes and wheat received 160 lbs. of acid phosphate on each crop, the wheat yield rose to 39 bu. in 1915 with an average of 35.4 bu. for the entire period. The addition of the acid phosphate of 100 lbs. of muriate of potash each for potatoes and wheat increased the yield to 49.7 bu. in 1915 and to 35.6 bu. for the entire period. A further addition of nitrate of soda, 80 lbs. per acre on potatoes and 160 lbs. on wheat, raised the wheat yield for 1915 to 43.2 bu. and for the 21 years to 37.7 bu. This was the same fertilizer application that raised the continuously grown wheat from 7.5 to 19.3 bu.

In a 5-year rotation with corn, oats, clover, and timothy, wheat without fertilizer treatment yielded 8.7 bu. per acre in 1915 and 10.6 bu. as the 22-year average on land that had never been limed, as compared with 15 bu. for 1915 and 11.7 bu. for the 22 years on land which had received a ton of quicklime per acre in 1903 and 2 tons of ground limestone 10 years later. Acid phosphate

at the rate of 160 lbs. per acre increased the yield for 1915 to 18.6 bu. on the unlimed land and to 20 bu. on the limed land. One hundred lbs. muriate of potash added to the acid phosphate produced a further increase of a bushel per acre for the 22 years in both cases, and the complete fertilizer in the same quantities given for the experiments above described increased the yield for 1915 to 33 bu. on both unlimed and limed land and to 27.5 bu. for the 22-year average, the nitrate of soda partly taking the place of lime.

In addition to these plat experiments, a 40-acre field at the station has grown 10 acres of wheat annually for 22 years in a 4-year rotation with corn, oats, and clover. The first 10 years the wheat land was top-dressed before seeding with about 10 tons of barnyard manure per acre and the 10-year average yield was 20 bu. Then the manure was reinforced with about 40 lbs. of acid phosphate per ton and spread on clover sod which was plowed under for corn. The corn received a dressing of about 1.5 tons of limestone per acre and the wheat received 350 lbs. per acre of a fertilizer made up of steamed bone meal, acid phosphate, and muriate of potash with 50 lbs. of nitrate of soda added in April if the growth was not too rank. The wheat yield on this field for 1915 was nearly 36 bu., and the average yield for the past 10 years 34 bu. per acre.

HORTICULTURE.

[Report of horticultural investigations], W. H. LAWRENCE and S. B. JOHNSON (*Arizona Sta. Rpt. 1915. pp. 539-552*).—A progress report on various lines of work for the year.

Studies with processed fabrics prepared for use in protecting citrus trees during injurious low temperatures (E. S. R., 33, p. 48) were continued, and observations reported as to semitransparency, air-tightness of covers, radiation of heat from covers, distribution of heat, and changes of temperature due to wind currents under covers.

The results are given of fruit-thinning experiments conducted with a number of young date trees. These results, together with observations and study of the influence of thinning fruit on old trees, led to the following conclusions:

"The date palm is a plant having a natural method of thinning fruit. The fruit begins to drop shortly after pollination takes place and continues long after the reduction to one of the three carpels occurring in each floral cup, sometimes continuing into the harvest period. Trees not bearing a maximum crop will mature fruit to size and quality with little or no change in earliness of ripening. Natural methods of thinning fruit early in the season have a greater tendency to increase the size of the berry, in proportion to the number in the bunch, than is induced by artificial removal of a number of berries later in the season following natural thinning. Artificial thinning may be done to advantage only after the bearing capacity of a tree has been determined.

"Thinning may be done most effectively and quickly by the removal of an entire fruiting branch. This method not only increases the weight of the berry but of the entire bunch, including the brush. Thinning may be done profitably when the tree is carrying in excess of a maximum load. Under these conditions bunches with one-half the spikes removed begin to ripen their fruit earlier than the nonpruned bunches, which come second in order, while those with one-half of each spike removed mature the fruit more slowly. In general, fruit of inferior size occurs on the slender-stemmed bunches, bearing weak branches."

In a cultural test of winter radishes the white varieties gave the best results. For rate of maturity and length of time the roots continue to grow and remain edible, White Icicle was the first choice.

Some data are given on the range of soil temperatures during the season, and the importance of using such records to determine dates for planting, methods of irrigation, and rate of growth of vegetables until edible maturity is pointed out.

Observations and data secured from experiments in the station's European and American grape vineyard during the fruiting seasons of 1914 and 1915 are here summarized under the general headings of bearing habits of the plant, systems of pruning, yields per season, date of blooming, weight of average size bunches, date of picking, decrease in size of berries, decrease in number of berries per ounce, comparison of yields for separate pickings from all hills of each variety, and yield of fruit.

In an olive orchard planted late in March and early in April, 1914, it was noticed early in May that many of the trees were discolored. Near the middle of the month a considerable increase in the cankered areas was noted, but all attempts to isolate an organism gave negative results. A further study showed that the trouble made its appearance on the trees first on the south or southwest side and near the ground.

Some experimental work was carried on in which plantings were made under various conditions, and it was found that sun scald of newly planted olive trees occurs under certain conditions. Small, weak-growing trees usually died before sun scalding took place, while large growing stems were not affected. Shading the trees did not prevent sun scald, while flooding with irrigation water and the use of hot soil as a surface mulch, with subirrigation, favored the scalding. Medium-sized trees that gave up their water slowly were found most susceptible to the injury. Scalding took place only during periods of intense heat, and under average field conditions is limited to the area just above the ground. Fall, winter, or early spring planting is deemed more desirable than late spring planting, and trees should be headed back at the time of planting in order to reduce the evaporation as much as possible.

Report of the horticultural department. J. E. Higgins (*Hawaii Sta. Rpt. 1915, pp. 29-27, pls. 2*).—The work of the department was continued along lines previously noted (*E. S. R.*, 32, p. 741).

The station is cooperating in experiments in Florida and in California with the view of extending the culture of litchi (*Litchi chinensis*). Some successful experiments in transporting these short-lived seeds under refrigeration from Honolulu to San Francisco and thence by ordinary express and by mail in moist sphagnum moss to Washington, D. C., and to various localities in California are noted. All of this seed germinated well, thus indicating that litchi seeds may be transported where refrigeration for fruit is available.

In the work with mangoes some preliminary studies have been made on the flowers of certain varieties and on methods of pollination. Several mango seedlings less than nine months old, which had been grafted by inching, were found to be producing flower clusters above the point of union, and in most cases the scion also was flowering. The mango tree ordinarily does not flower until it is from five to six years old. No cause is ascribed for these phenomena, except the grafting. An instance of bud mutation is reported in which a single branch of one of the trees bearing green fruit produced a pink fruit rather smaller in size than the regular type but otherwise resembling the variety. Bark grafting the mango, which has previously been successfully applied by the Porto Rico Experiment Station, has proved to be well adapted under Hawaiian conditions to the work of top grafting established trees. The process is here described.

In the work with avocados the Macdonald, the parent tree of many of the round, hard-shelled winter seedlings, has attracted some attention by its remarkable keeping qualities. The fruits were kept in the horticultural laboratory for 16 days without any refrigeration, being in a perfect state of preservation at the end of this time.

In the work of propagating the avocado, scion budding has given satisfactory results. The scions are inserted in a T-shaped incision similar to that made for shield budding, only much larger. After being tied in place the budded scion is waxed with a firm grafting wax which will not run when heated by the sun. This method is considered to be advantageous as a means of propagating from old bearing trees which frequently do not produce good bud wood unless severely cut back. It may also be used to work branches of considerable size. Observations of apparently multiple-stemmed seedling avocados showed that such seedlings have a single central stem, the other stems arising from buds on this stem beneath the surface of the ground and in many cases within the seed.

The work of breeding papayas was resumed along lines previously noted. A number of crosses and close pollinations have been made to secure information on questions arising in earlier work.

In the citrus orchard many varieties are now in bearing and making a satisfactory growth. Practically all of these varieties have been introduced as bud wood and worked upon home-grown stocks.

In view of the claim by some manufacturers that a blend of the oil of kukui (*Aleurites moluccana*) and of the China wood oil (*A. fordii*) is preferable to either one, some work was undertaken by V. S. Holt in hybridizing these species with the idea that the new forms might combine the desired characters in a way superior to either of the parents. A number of fruits from these cross pollinations have been secured.

Brief notes are given on the station's distribution of seeds and plants and extension work in horticulture.

A variety test of tomatoes, C. E. MYERS (*Pennsylvania Sta. Rpt. 1914, pp. 461-462*).—In continuation of a previous report (E. S. R., 34, p. 146) tabular data are given on a test of different strains of a number of varieties of tomatoes. With a few exceptions each variety recorded has been tested for three years. The varieties are classified according to their period of maturity, described, and discussed with reference to their quality and commercial importance.

Influence of dynamiting on soils, W. R. WHITE (*Pennsylvania Sta. Rpt. 1914, pp. 445-457*).—In continuation of a previous report (E. S. R., 34, p. 125) the second year's results are given from those dynamiting experiments, which were conducted in orchards. Although these results are not considered conclusive thus far, they indicate, as in the previous year, that the profitable application of dynamite as a soil improver is limited. In these experiments no important gains have as yet been derived from its use either with newly-planted apple trees or with mature trees.

Irrigation, R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 24-26, fig. 1*).—Practical suggestions are given for irrigating orchards, both where cover crops are used and where clean tillage is practiced.

Cover crops, C. I. LEWIS and R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, p. 29*).—Notes are given of a test of various cover crops on a number of distinct soil types in the fall of 1914. The crops tested include field peas, horse bean, crimson clover, hairy vetch, spring or common vetch, woolly-podded vetch, purple vetch, and bitter vetch.

As a result of the severe winter only the crimson clover and hairy vetch survived and made satisfactory growth to be of value for green manuring. The

authors point out, however, that field peas may be grown in the spring for green manure as well as for forage or for grain. Crimson clover reaches the proper size for use as green manure too late in the spring to be of very great value. Of the newer vetches—woolly-podded, bitter, and purple—the first two are promising but do not appear to be much more hardy than spring vetch. Spring vetch succeeds well in ordinary years and, unlike hairy vetch, the seed is cheap and easily obtained, hence it will of necessity be most generally used.

Results from experiments on cultural methods, cover crops, and fertilization in apple orchards. J. P. STEWART (*Pennsylvania Sta. Rpt. 1914, pp. 423-438*).—In continuation of a previous report on this subject (*E. S. R., 34, p. 148*) the author reviews some of the more practical results secured from certain of the orchard fertilizer experiments. The principal results from the other orchard experiments of the station are appended in tabular form.

The results secured from cultural methods in the younger orchards are, in general, not materially different from those previously given. Some of the recent results in the more mature orchards, however, conflict with previous results, the tillage and cover crop plats giving the best yield in some cases and mulched trees the best yield in other cases. In the latter cases definite amounts of plant food have also been added to both the cultural plats and the mulched plats. Tree growth has continued to be decidedly greater throughout the experiment for the tillage and cover crop treatment.

Observations on the experiments as a whole appear to demonstrate the feasibility of obtaining practically annual crops from such supposedly refractory biennial bearers as the Baldwin, York Imperial, Spy, and Tompkins King, provided the conditions are made right. The results also indicate that annual tillage should be done with double-action disks or cutaways or their equivalent in preference to regular plows, wherever the soil conditions will permit.

In one experiment, here noted, the influence of fertilization surpassed that of cultural methods as regards yield. The application of nitrogen with phosphate to sod or of manure to sod gave strikingly greater yields than sod mulch or tillage and cover crop methods of culture. Phosphate with potash applied to sod gave a material gain over sod alone but was less effective in influencing the yield than sod mulch or tillage and cover crop.

From the results secured in this work to date a general fertilizer formula carrying about 30 lbs. of actual nitrogen, 50 lbs. of actual phosphoric acid, and from 25 to 50 lbs. of actual potash, applied at the rate of 500 lbs. per acre to bearing trees, is recommended. Attention is called, however, to the need of adjusting the fertilizer to individual orchards.

Intercrops for apple orchards. J. P. STEWART (*Pennsylvania Sta. Rpt. 1914, pp. 439-445*).—In this paper the author calls attention to the value of intercrops in reducing the cost of young orchards and gives concise directions for growing the various intercrops in the orchards.

The influence of nitrogen upon the vigor and production of devitalized apple trees. C. I. LEWIS and R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 5-19, pl. 1, figs. 4*).—Further results are given of some of the station's orchard fertilizer experiments in which the ingredients are being applied both in the dry form and in solution (*E. S. R., 35, p. 235*).

The present report deals specifically with the effects of nitrogen, which is the only element that has given results. In the previous year's work beneficial results were secured by spraying trees with a solution of nitrate of soda and caustic soda, thus confirming the results reported by Ballard and Volck (*E. S. R., 30, p. 640*). Subsequent experiments, however, lead the authors to conclude that the real reason why better results were secured from spraying nitrate of soda than applying it in the dry form was due to the

fact that the nitrogen sprayed on the trees was dissolved and reached the roots, whereas the nitrates spread on the ground were added in May when the ground was dry, hence did not dissolve and reach the roots. In order to secure benefit from the nitrates they should be applied during the early part of March when the ground is sufficiently moist to dissolve them and also before the trees come into bloom. Nitrogen applied at this time has been found to cause a larger percentage of set of fruit in April, an important change in the character of the foliage, and a stimulation of the wood growth.

The experiments indicate that the stimulating effect of nitrate of soda is more lasting in its effects than formerly believed and that its benefits will extend over into the second season and perhaps longer. The best method of applying nitrate of soda to orchards is to spread the dry crystals broadcast on the ground under the trees and harrowing soon after applying. Six lbs. of nitrate of soda, equal to about 1 lb. of actual nitrogen, applied to a mature bearing tree is believed to be ample to restore seriously weakened trees to a normal condition. This amount should be reduced one-half the second year, the station's experiments showing that a full pound of nitrogen applied the second year produced too much wood growth and too much fruit that was undercolored and oversized. The cost of furnishing the required nitrogen at the rate recommended was \$15 an acre.

The above amounts of fertilizer are recommended for use only on trees which are in a somewhat run down condition as indicated by thin foliage, weak wood growth, small fruit, and the presence of certain physiological troubles, such as "fruit pit," little leaf, die-back, etc.

Further experiments are to be conducted to confirm these conclusions as a whole.

The authors point out that nitrate of soda does not exert much influence on the soil, and therefore in order to improve the physical condition of the soil in many orchards it is necessary to add organic matter. During the last two years those orchards which have used clover and alfalfa in the presence of sufficient moisture have shown a strong improvement. The use of these leguminous crops should be dispensed with for a while and systematic clean culture practiced when signs of over stimulation appear.

Condition of root system of apple trees in the Hood River district, R. W. ALLEN (Oregon Sta., Rpt. Hood River Sta., 1915, pp. 20-24, figs. 2).—The results are given of a preliminary investigation started in 1913 to determine in a general way the condition of the root system of apple trees in orchards varying in age and under different cultural treatment.

In the orchards examined many of the fibrous roots of the trees were dead, this condition being worse in old orchards kept under clean cultivation and without irrigation. Sod culture without irrigation was very similar in result to that of continuous clean culture, but the conditions, as a whole, were worse where shallow implements of tillage had been used. Sod culture in which clover had been grown with irrigation showed the soil and roots of trees to be in very good condition.

"Fruit pit" was found to be worse under the worst conditions of the soil and upon trees having root systems in the most critical condition. In less serious conditions of soil the roots of "pit" trees were either normal in vigor or nearly so. Winter injury appeared to be most prevalent on soils of poor condition, but no relation was found to exist between the seriousness of the trouble and the condition of the roots of the trees. The investigation as a whole strongly indicates that the weak and yellow condition of the trees, much of

the fruit pit, and winter injury now so prevalent in the orchards are due to drought and improper fertilization.

Winter injury to apple tree roots (*Wisconsin Sta. Bul. 268 (1916), pp. 15, 16*).—Observations made by the horticultural department on root killing of apple trees show that when there is a blanket of snow upon the ground even excessive variations in air temperatures do not cause much fluctuation in soil temperatures; hence cover crops which hold the snow aid in preventing winter-killing.

The results of one year's work further indicate that the roots arising from scions of hardy varieties of apples can withstand greater cold than roots of equal size developing from the stock. Considerable difference existed in the ability of scion roots of different varieties to resist low temperatures. Scion roots of the Wealthy, for instance, are much harder than those of the North-western Greening. J. G. Moore of the station has observed that ordinarily no scion roots are produced the first year. Usually those produced the second season are small, and less than 50 per cent of the 3-year-old apple stock had any scion root development. Consequently too much reliance can not be placed upon the development of scion roots by young trees as a factor to enable the trees to resist winter conditions.

Ripening of growing parts of orchard trees and shrubbery. A. D. SELBY (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 206-208, fig. 1*).—Attention is called to the danger of the unripened condition of orchard trees and shrubbery due to various causes, with suggestions for the ripening of the wood so that winter injury does not follow. Among the causes of the unripened condition are heavy manuring, excessive pruning, late cultivation, defoliation by leaf spot and other fungi, etc.

Suggested grades for peaches. M. A. BLAKE and C. H. CONNORS (*New Jersey Stas. Circ. 58 (1916), pp. 8, figs. 4*).—In continuation of suggestions relative to grading peaches given in a previous bulletin of the station (*E. S. R. 34, p. 639*), the experience gained during 1915 is included in the present circular. A descriptive outline for standard varieties is given showing the amount of color these varieties should have to be classed as "fancy" fruit.

Horticultural observations in Porto Rico, Cuba, and Florida in relation to the horticulture of Hawaii. J. E. HANSEN (*Hawaii Sta. Rpt. 1915, pp. 58-73, pls. 3*).—A comparative study of the fruit industries in Porto Rico, Cuba, and Florida, with special reference to similar industries in Hawaii. The fruits considered include the pineapple, citrus fruits, the avocado, and the mango. Information is given relative to the extent of the industries, cultural methods, principal diseases and insects, and marketing.

FORESTRY.

Third biennial report of the state forester, 1914. J. C. VAN HOOK (*Birn. Rpt. State Forester Mont., 3 (1913-14), pp. 35, pl. 1*).—A brief account is given of the lumber industry in Montana, together with descriptions of the commercial woods of the State, methods of administering the state forests, and the work of forest protection.

Fifth annual report of the state forester, F. A. ELLIOTT (*Ann. Rpt. State Forester Oreg., 5 (1915), pp. 22*).—A progress report on the work of the State Board of Forestry, with special reference to the work of forest protection.

Report of the state fire warden, C. P. WILMER (*Ann. Rpt. Dept. Conserv. and Develop., N. J., 1915, pp. 47-77, pls. 3*).—The report of the 1915 season relative to the work of forest fire protection in New Jersey.

Report on forest operations in Switzerland (*Rap. Dépt. Suisse Int., 1915, pp. 1-10*).—A report on the administration and management of the state, community, and private forests in Switzerland, including tabular data showing yields in major and minor products, revenues, expenditures, etc., as well as operations in forest extension.

Report on the forest administration in Burma for the year 1914-15, C. G. ROGERS (*Rpt. Forest Admin. Burma, 1914-15, pp. VI+169*).—The usual progress report relative to the administration and management of the state forests in Burma, including a financial statement for the year. The important data relative to alterations in forest areas, forest surveys, miscellaneous work, revenues, expenditures, etc., are appended in tabular form.

Annual report on the forest administration in Ajmer-Merwara for the year 1914-15, HUKAM CHAND (*Ann. Rpt. Forest Admin. Ajmer-Merwara, 1914-15, pp. 4+28*).—A report similar to the above relative to the administration of the state forests in Ajmer-Merwara during 1914-15.

Report on forest administration in the Andamans for 1914-15, J. W. A. GRIEVE (*Rpt. Forest Admin. Andamans, 1914-15, pp. 4+38*).—A report similar to the above relative to the administration of the state forests of the Andamans for the year 1914-15.

Administration report of the forest circles in the Bombay Presidency, including Sind, for the year 1914-15 (*Admin. Rpt. Forest Circles Bombay, 1914-15, pp. II+180+4*).—A report similar to the above relative to the administration of the state forests in the Northern, Central, and Southern Circles of the Bombay Presidency, and of Sind.

Progress report of forest administration in Coorg for 1914-15, H. TREMAN (*Rpt. Forest Admin. Coorg, 1914-15, pp. 3+13+13*).—A report similar to the above relative to the administration of the state forests in Coorg for the year 1914-15.

Seeding and planting, J. W. TOUMEX (*New York: John Wiley & Sons, 1916, pp. XXXVI+455, figs. 140*).—A manual of information on seeding and planting in forest practice, with special reference to conditions in the United States. In the preparation of the work the forestry literature of Europe has been freely drawn upon for the principles underlying these practices.

In part 1, under the general heading of silvical basis for seeding and planting, consideration is given to definitions and generalities, the choice of species in artificial regeneration, the principles which determine spacing, and the principles which govern the composition of the stand. Part 2 takes up the artificial formation of woods, consideration being given to forest tree seed and seed collecting, the protection of seeding and planting sites, preliminary treatment of seeding and planting sites, establishing forests by direct seeding, the forest nursery, and establishing forests by planting.

The testing of pine seeds, A. GRISCH (*Landw. Jahrb. Schweiz, 30 (1916), No. 2, pp. 210-224, figs. 2*).—A report on the knowledge of the count and weight methods of testing pine seeds.

Observations on some oaks with persistent foliage, G. DONATI (*Ann. Bot. [Rome], 13 (1915), No. 2, pp. 157-168, figs. 13*).—The author here presents a comparative study of the leaf structure of *Quercus ilex*, *Q. suber*, *Q. occidentalis*, and *Q. coccifera*.

A list of the recognized woods of British Guiana (*New York: The British Guiana Consolidated Co., Ltd. [1916], pp. 18, figs. 6*).—A descriptive list of British Guiana woods compiled from various government reports. Information is given relative to the specific gravity of the wood, appearance, physical texture, and uses.

Rubber (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 594-728, fig. 1*).—This includes abstracts of the following papers on rubber, including reports of discussions, at the Third International Congress of Tropical Agriculture, London, July, 1914: The Cultivation of *Hevea brasiliensis* in Uganda, by S. Simpson (pp. 594, 595); Diseases of Hevea in Ceylon, by T. Petch (pp. 596, 607); On Some Animal Pests of the Hevea Rubber Tree, by E. E. Green (pp. 608-636); *Terms gestroi* as a Pest of the Para Rubber Tree, by H. C. Pratt (pp. 637-640); The Principles of Hevea Tapping, as Determined by Experiment, by T. Petch (pp. 641-651); The Preparation of Plantation Para Rubber, by B. J. Eaton (pp. 652-678); Spottings in Plantation Rubber Due to Fungi, by A. Sharples (pp. 679-687); Ceara Rubber Cultivation and Manufacture in Southern India, by R. D. Anstead (pp. 688-696); The Cultivation of *Manihot glaziovii* in Uganda, by S. Simpson (pp. 697, 698); Increase in Yield from *Funtumia elastica* in Belgian Kongo by the Sparano Method, by A. Gisseleire (pp. 699-701); The Methods of Tapping Cultivated Castilla Trees, and the Yield of Rubber Therefrom, by P. Carmody (pp. 702, 703); The Methods of Tapping Castilla Rubber Trees in Mexico, and the Yield of Rubber Which the Trees Furnish, by A. Russau (pp. 704-712); Rubber Culture in the German Colonies, by F. Frank (pp. 713-719); Necessity to the Rubber Industry of the Exact Laboratory Determination of the Respective Values of Rubber, by Lamy-Torrillon (pp. 720-722); and Contribution to the Knowledge of the Mechanism of Coagulation in Certain Rubber-Yielding Species, by F. Heim and R. Marquis (pp. 723-728).

A comparison of the Brazilian and plantation methods of preparing Para rubber, G. S. WHITBY (*Jour. Soc. Chem. Indus.*, 35 (1916), No. 9, pp. 493-504).—In this paper the author describes a comparative test of the methods of preparing plantation rubber in the eastern Tropics and the wild rubber of Brazil.

The rubber industry of the Amazon and how its supremacy can be maintained, J. F. WOODROFFE and H. H. SMITH (*London: John Bale, Sons & Daniels son, Ltd., 1915, pp. XLVIII+435, pls. 42, figs. 4*).—This work comprises a study of the rubber industry and the labor, social, and various economic conditions in Brazil, with special reference to pointing out ways and means for the future development and maintenance of the rubber industry in connection with the general development and settlement of the Amazon region.

DISEASES OF PLANTS.

Plant pathology problems (*Wisconsin Sta. Bul. 268 (1916), pp. 18-25, figs. 6*).—Brief accounts are given of the various investigations in plant diseases that are being carried on by the department of plant pathology. This work includes a study of leaf roll and similar troubles of potato, seed disinfection for the control of scab and Rhizoctonia, studies of nonparasitic diseases of potato such as black heart, a study of alfalfa diseases, and the control of barley diseases, cabbage yellows, and cucumber diseases.

For the control of barley diseases, A. G. JOHNSON has investigated the effect of planting at intervals of two weeks throughout the season with the result that the early plantings in most cases developed more disease than the midsummer plantings. Attempts were made to control the stripe and blotch of barley by treating the seed with hot water, solutions of copper sulphate, copper sulphate and salt, corrosive sublimate, and formalin, with the result that warm solutions of formalin proved to be the most satisfactory treatment. Soaking seed for three hours in a solution of 1 pint formalin to 30 gal. water at a temperature of 68° F. gave satisfactory control not only of the stripe disease but also of the loose and covered smuts.

The work begun by the department of plant pathology some years ago in developing resistant strains of cabbage has resulted in the establishment of such strains and the production of a considerable amount of seed for testing in 1916. Trials made in different regions indicate that the disease-resistant quality is maintained even in widely different localities. In connection with this disease, J. C. Gilman has observed that the growth of the parasitic organism causing it is greatly increased at temperatures above 64°. This, it is believed, will explain why the disease is so much more serious in some seasons than in others, and also indicates that it will not be so severe in the northern as in the southern parts of the State.

Some observations on pea blight were continued, and the former recommendations of careful preparation of seed bed and attention to drainage are repeated. For the disposal of the refuse vines the use of silos is suggested.

Some investigations had been begun on cucumber diseases, of which wilt, angular leaf spot, anthracnose, and scab are said to be due to definite parasites, while a fifth, white pickle or cucumber mosaic disease, is not known to be due to any organism. These five diseases are said to be more or less serious in Wisconsin. The white pickle or cucumber mosaic disease is characterized by irregular malformed fruits which are usually worthless for pickling purposes. The trouble is considered transmissible, but as yet no parasite has been discovered. Similar conditions have been found to obtain with squash and watermelon, from which the disease may be transferred to the cucumber.

Studies on the crown gall of plants. Its relation to human cancer, E. F. SMITH (*Jour. Cancer Research*, 1 (1916), No. 2, pp. 231-309, figs. 92).—The present paper, which reviews certain of the essential features of crown gall, especially as they bear upon the general problems of cancer, also contains a number of new observations which are considered to bring this vegetative growth into relations with the group of tumors described as embryomata.

The author calls attention to the growth without function exhibited by the crown gall tumors, the cell itself being properly regarded as parasitic only in the sense that it is urged on by a schizomycete, *Bacterium tumefaciens*, and to the embryonic character of the proliferating tumor cells. Attention is called also to the atypical arrangement of the tissues, to their loss of polarity, and to the slight differentiation of the cells accompanying their increase in vegetative vigor. The neoplastic character of the growths is emphasized by the noncapsulate marginal growth, the imperfect vascularization, the early central necrosis, the existence of intrusive strands, and the occurrence of daughter tumors, which reproduce the original tumor. The same micro-organism is capable of producing by inoculation different types of tumors varying in structure according to the type of tissue invaded, the most complex type containing, along with blastomous elements, a jumbled and more or less fused mass of embryonic organs and fragments of organs comparable, if not equivalent, to the foetal organs occurring in the atypical animal teratoids.

The distribution of black rust in Norway, E. HENNING (*Meddel. Centralanst. Försöksv. Jordbruksområdet*, No. 107 (1915), pp. 16; *K. Landtbr. Akad. Handl. och Tidskr.*, 54 (1915), No. 2, pp. 122-135; *abs. in Bot. Centbl.*, 128 (1915), No. 18, pp. 495, 496).—It is thought that the barberry was introduced into Scandinavia at least as early as the beginning of the seventeenth century, and black rust of wheat (*Puccinia graminis*) not later than the eighteenth, and possibly in the seventeenth, century. Since this time the barberry has been used as alternate host, both barberry and fungus being more successful in the middle and southern portions than in the north, where the rust has little economic importance.

Diseases of garden vegetables in Switzerland, E. MAYOR (*Ramenz Sapin*, 48 (1915), pp. 39, 40, 44-47; 49 (1915), pp. 7, 8, 12-15; *abs. in Bot. Centbl.*, 129 (1915), No. 1, p. 6).—A brief review is given of diseases of garden vegetables, particularly in the Canton of Neuchâtel, also of corresponding control measures.

The physiology of *Phoma betæ*, R. SCHÄNDER and W. FISCHER (*Landw. Jahrb.*, 48 (1915), No. 5, pp. 717-738).—Reports of previous investigations by one of the authors (E. S. R., 28, p. 628; 33, p. 53) are followed up with a detailed account of studies on *P. betæ* as affected by modifications of the nutritive medium, by temperature, and by poisons as employed in sprays.

Hot water does not seem to be practically protective against this fungus. Among the more satisfactory chemical sprays mentioned are corrosive sublimate and a few proprietary preparations.

Club root of cabbage, C. HAMMARLUND (*Meddel. Centralanst. Försök. Jordbruksområdet*, No. 106 (1915), pp. 14, figs. 7; *K. Landtbr. Akad. Handl. och Tidskr.*, 54 (1915), No. 2, pp. 110-121, figs. 7).—Experiments on control of cruciferous club root (*Plasmiodiophora brassicæ*) gave results which were most favorable to formalin in regard to the expense, which is only one-third that of carbon bisulphid, and in regard to its harmlessness as compared with lime in large percentages. It was proved that the disease is spread by feeding the diseased plants to cattle, which does not destroy the organism, though its dispersal in this way may be avoided by thoroughly cooking the plants.

Glæosporium caulivorum injuring red clover in Hungary, D. HEGYI (*Mezőgazdasági Szemle*, 33 (1915), No. 2, pp. 55-58; *abs. in Internat. Inst. Agr. [Rome]*, *Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 4, p. 637).—In different portions of Hungary, but particularly those along the right bank of the Danube, great injury was done in 1914 to red clover by *G. caulivorum*. As the fungus is thought to be carried by the seeds, it is recommended that these be soaked in 1 per cent solution of copper sulphate before planting.

Transmission and control of bacterial wilt of cucurbits, F. V. RAND and ELLA M. A. ENLows (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 11, pp. 417-434, pls. 2, figs. 3).—The authors have made a study of insect transmission of the bacterial wilt of cucurbits. Experiments, as far as completed, indicate that cucumber beetles (*Diabrotica* spp.) are the most important, if not the only, carriers of the wilt organism (*Bacillus tracheiphilus*), and that at least one species (*D. vittata*) is capable of carrying the wilt over winter and infecting the spring plantings of cucumbers.

In spraying experiments carried on in 1915, the wilt was effectively controlled by a spray consisting of a combination of Bordeaux mixture and arsenate of lead. Plats sprayed with either alone showed less wilt than unsprayed plats, but the control was not so complete as when the two were used together. Inasmuch as it has been proved that insects are the carriers of the disease, insect control becomes necessary for preventing the wilt. This phase of the work is to be given further study in cooperation with the Bureau of Entomology of this Department.

Bacteriosis of cucumber in Italy, G. B. TRAVERSO (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat.*, 5, ser., 24 (1915), 1, No. 5, pp. 456-460).—A serious bacterial disease of cucumbers is described as having appeared in May, 1914, following a severe outbreak of *Glæosporium lugenarium* in 1913. The disease appears on the adult leaves and the fruits while the roots and young shoots are still normal. Bordeaux mixture, if applied to the plants when very young, is thought to have some protective value.

Leaf rust of cucumber, P. SPENGER (*Mitt. K. K. Gartenbau Gesell. Steiermark*, 41 (1915), No. 1, pp. 4, 5; *abs. in Bot. Centbl.*, 123 (1915), No. 15, p.

415).—Against *Corynespora melonis*, causing a spread of leaf rust in Germany, a 1 per cent Bordeaux spray for the young plants is recommended as preventive. Seed should be kept for 1.5 hours in 0.5 per cent formalin before sowing. After the outbreak has occurred, it is necessary to destroy completely all plants with their fruits, or to remove them to some unused portion of the field which can be left uncultivated for several years.

Ginseng diseases and their control, H. H. WRETZEL, J. ROSENBAUM, J. W. BRANN, and J. A. McCLINTOCK (*U. S. Dept. Agr., Farmers' Bul. 736 (1916), pp. 23, figs. 26*).—This describes in a popular way the diseases of ginseng and their control, technical descriptions of the different diseases having been previously noted (*E. S. R., 27, p. 649*).

The neck rot of white onions, J. G. HUMBERT (*Mo. Bul. Ohio Sta., 1 (1916), No. 6, pp. 176-180, fig. 1*).—Results from an investigation on the neck rot of white onions, due to *Sclerotium cepivorum*, are given. This disease is said to have been the cause of heavy loss in stored onions, and experiments for control, including sanitation methods and fumigation with formaldehyde gas, have been carried on with some success. Dump heaps of rotting onions should not be permitted, and crates and storage houses should be disinfected if the new crop is to be kept free from disease.

This disease has been confused with smut, but this attacks the growing onions, while the neck rot is apparently a trouble which destroys the mature onions in storage.

Potato dry spot in Java, A. RANT (*Teyssmannia, 26 (1915), No. 5, pp. 285-287, pls. 2*).—A disease of potato leaves is described which is thought to be identical with early potato blight due to *Alternaria solani*.

Root rot of tobacco (*Wisconsin Sta. Bul. 268 (1916), pp. 17, 18, figs. 2*).—A brief account is given of the work of J. JOHNSON on the root rot of tobacco, due to *Thielavia basicola*, and methods for its control. Since certain strains of tobacco have been found to differ widely in susceptibility to the disease, an attempt is being made to develop a resistant type which will be of high quality and also able to grow on worn-out tobacco fields. Until such a type is secured, it is recommended that growers sterilize the soil of seed beds or plant on soil that has not grown tobacco in recent years.

Bacterial rot of tomato, V. PEGLION (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5, ser., 24 (1915), II, No. 3, pp. 157-160*).—A rot of tomato appearing in May, 1914, was reproduced in characteristic form by inoculation with a bacterium isolated from the decayed fruits. The organism appears to lose quickly much of its virulence in artificial substrata.

Root rot of fruit trees, J. J. THORNER (*Arizona Sta. Rpt. 1915, p. 530*).—In continuation of work by McCallum, discontinued in 1910, the author made an examination of orchards where root rot was causing serious loss. It is considered that more than one fungus is responsible for root rot, and in the absence of definite information, no positive methods for control can be given. This investigation is to be continued.

Study of *Coniothyrium pirina*, *Phyllosticta pirina*, and *C. tirolense*, ERISA MURRO and G. POLLACCI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5, ser., 24 (1915), II, No. 1, pp. 40-42*).—Evidence is adduced to show that the fungus denominated *C. pirina* by Sheldon (*E. S. R., 19, p. 249*) is, as that author suspected, not identical with *P. pirina* but that it has characters corresponding precisely to those of *C. tirolense*.

Tree crickets as carriers of *Leptosphaeria coniothyrium* and other fungi, W. O. GLOYER and B. B. FETTER (*New York State Sta. Tech. Bul. 50 (1916), pp. 3-22, pls. 4*).—The authors propose the name tree-cricket canker for a disease

of apple branches, in which areas of dead bark infested with *Coniothyrium fuckelii* surround oviposition punctures of tree crickets.

The constant association of this fungus with such cankers led to an investigation of tree crickets as its carriers. It was found that tree crickets may carry the fungus from raspberries to apple trees and infect them, and also that they may carry the spores of these and other fungi in the digestive tract as well as on the outside of their bodies. Feeding experiments showed that the spores of *Ustilago zea*, *Coprinus micaceus*, *Coniothyrium fuckelii*, *Nannularia discreta*, and *Sphaeropsis malorum* passed through the digestive tract of tree crickets without loss of viability.

Typical cankers resulted when tree crickets fed on *C. fuckelii* were allowed to oviposit on apple branches. The percentage of cankers formed about oviposition punctures was considerably greater when the crickets were fed with *C. fuckelii* from raspberry canes than when they were fed with pure cultures of the fungus isolated from apple branches. The oviposition punctures of *Oecanthus nivicus* gave a higher percentage of infection than those of *O. angustipennis*, and for both species the percentage of infection was considerably higher when the punctures were covered with grafting wax than when left uncovered. Typical cankers were also produced by inserting pellets of tree-cricket excrement into punctures made in apple branches and covering them with grafting wax.

Clean cultivation and the use of arsenical sprays are suggested as remedial measures for the control of tree crickets.

Collar blight of apple trees, C. R. ORTON and J. F. ADAMS (*Pennsylvania Sta. Rpt. 1914*, pp. 152-160, pls. 3).—This is an account of an investigation of collar blight of apple trees, due to the organism *Bacillus amylovorus*, a more extended report of which has been noted (*E. S. R.*, 34, p. 247).

The spraying experiments of 1915 in the Hood River Valley for the control of apple scab, J. R. WINSTON and L. CHILDS (*Oregon Sta., Rpt. Hood River Sta. 1915*, pp. 30-36, figs. 5).—A report is given of experiments carried on in the Hood River Valley for the control of apple scab which, in the last few years, has become a very serious pest in this region. In 1914, cooperative experiments were carried on with a number of growers, and in 1915 work was continued on three orchards in which Winesap and Newtown apple trees were sprayed with various fungicides to test their efficiency. Bordeaux mixture, soluble sulphur, barium tetrasulphid, atomic sulphur, and iron sulphid were tested in comparison with lime-sulphur solution. In addition, the time of application was studied, particular attention being paid to the delayed dormant application, in which trees were sprayed with a rather strong lime-sulphur solution just as the leaves were beginning to show from the winter buds.

The delayed dormant application proved valuable in some instances, increasing by about 12 per cent the sound fruit. Lime-sulphur proved the most efficient fungicide tested, the addition of atomic sulphur in one instance apparently decreasing its fungicidal properties, and the addition of iron sulphid apparently decreasing the fungicidal properties and slightly increasing the injurious qualities. Bordeaux mixture caused serious russetting of the fruit. The barium tetrasulphid used in strengths recommended by the manufacturers did not prove so efficient as lime-sulphur in controlling scab. Atomic sulphur proved a very poor substitute for lime-sulphur in the later applications. Soluble sulphur was less efficient and decidedly more injurious than lime-sulphur, but it was more efficient than atomic sulphur, iron sulphid, or barium tetrasulphid.

Based on two years' work, the authors claim that by thorough application of fungicides apple scab may be controlled in the Hood River Valley, even in years favorable to epidemics of the disease. A tentative spray calendar for

1916 is given for the control of scab and mildew, or of scab alone, in the Hood River Valley. This includes the use of lime-sulphur as a delayed dormant spray, followed by a more dilute lime-sulphur just as the petals are beginning to open, with a third spraying immediately after the petals have fallen. In the third spraying the authors recommend the use of atomic sulphur if the weather is clear and warm, or lime-sulphur with atomic sulphur added if the weather is cool and rainy. Two other applications are recommended, depending upon conditions in the orchards. In the first application, for the control of purple aphid *nicotinae* may be used, and in the third and fifth lead arsenate may be added to the fungicide as a protection against codling moth injury.

Six years of experimental apple spraying at Highmoor Farm, W. J. Morse (*Maine Sta. Bul.* 249 (1916), pp. 81-96).—In previous publications (E. S. R., 33, p. 648) accounts have been given of the results obtained from spraying experiments for control of apple scab. In the present bulletin an attempt is made to present a general summary of the more important results obtained. The primary object of the experiments was to determine an efficient and economical control of apple scab with a minimum amount of injury to fruit and foliage, as applied under Maine conditions. With the different fungicides, arsenate of lead was added as an insecticide at the rate of 2 lbs. of paste or 1 lb. of powder to 50 gal. of solution.

A comparison was made of 3:3:50 Bordeaux mixture and a standard dilution of lime-sulphur which was equivalent to a 1 to 40 dilution of a 33° Baumé concentrate. Bordeaux mixture, while efficient in scab control, nearly always caused serious leaf injury, and sometimes resulted in a considerable russetting of the fruit. Lime-sulphur of standard dilution gave little leaf injury, but was somewhat less efficient in controlling the disease.

The effect of different dilutions of lime-sulphur was investigated, and a spray containing 25 per cent less of the concentrate than the standard dilution resulted in the appearance of more scab than where the standard dilution was used. A comparison was made between the standard dilution and one 20 per cent stronger for four successive seasons, and it appears that on the Ben Davis apple a solution of lime-sulphur at least 20 per cent stronger than the standard dilution can be used with comparative safety.

The importance of a first application at the time of the blossoming period was also tested, and while some increase was given during certain seasons, yet the general results indicated that failure to spray at this time did not greatly reduce the efficiency of subsequent applications.

Arsenate of lead used alone in the progress of these experiments was found to have considerable value as a fungicide. In some instances trees receiving arsenate of lead gave almost as good control as where the insecticide was used in combination with the fungicide.

Notes are given on the effect of strong fungicides used as a first application followed by arsenate of lead alone, and the effect of dormant sprays for insects used in combination with the regular summer sprays. A comparison was made between self-bolled lime-sulphur and other forms of this fungicide which indicates that it is less efficient than the dilutions made from certain commercial brands of lime-sulphur concentrate. A trial was made of copper-lime-sulphur which indicated that, so far as scab control is concerned, it is about as efficient as the same dilution of lime-sulphur, but the presence of copper resulted in considerable foliage injury. Extra fine sulphur flour was found to possess considerable fungicidal value.

Comparative tests were made of a number of proprietary spraying compounds. Sulfocide, while efficient in scab control, caused a considerable amount of

injury to the fruit. Soluble sulphur was tested two years, and while it proved an efficient fungicide, at the dilutions tested it is considered unsafe as a summer spray for apple foliage. Another proprietary compound used was atomic sulphur. This caused no injury to the fruit or foliage, and scab control and percentage of perfect apples was nearly the same as that secured with lime sulphur.

"Sooty blotch" of the pear, E. S. SALMON and H. WORMALD (*Gard. Chron.*, 3. ser., 59 (1916), No. 1518, pp. 58, 59, figs. 4).—Sooty blotch of pear and apple is described, with the differences apparent between these two hosts. It is considered probable that the disease is caused by *Leptothyrium carpophilum*, though the pycnidial stage of the fungus has not yet been found. The disease is distinguished from scab (*Fusicladium*) by the fact, among others mentioned, that the sooty blotch develops after the fruits are stored.

Crown gall on raspberries and blackberries, P. THAYER (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 7, p. 218).—An account is given of a study on the occurrence of crown gall on raspberries and blackberries. In 1911, 99 rows, including all the leading varieties of blackberries and raspberries, were planted, and in 1916 the plantation was dug out and the plants all inspected. Of the black and purple raspberries, not a single sound plant was found and all varieties of red and yellow raspberries were more or less subject to root gall, although there was considerable variation in the amount of infection. A marked immunity was shown by the blackberries. With the exception of a few nodules found on the variety Lawton and a few canes of McDonald not a single plant of the native varieties of blackberry was found affected.

[Grape diseases] (*Bol. Agr. [São Paulo]*, 16. ser., 1915, Nos. 10, pp. 836-845; 11, pp. 921-936, figs. 4; 12, pp. 1017-1022, figs. 2).—Information is given regarding two fungus diseases of grape, *Peronospora viticola* and *Oidium tuckeri*, which cause loss in São Paulo, also regarding their control by copper and other sprays employed in connection with these two diseases.

Citrus canker, F. A. WOLF (*Alabama Col. Sta. Bul.* 199 (1916), pp. 91-109, pls. 2, figs. 6).—In a previous publication, the author gave an account of investigations of citrus canker (*U. S. R.*, 35, p. 152). The present publication contains a brief account of the more important results of these investigations, together with a compilation of information drawn from other sources.

A disease of the oil palm in the Belgian Congo (*Bul. Imp. Inst. [So. Kensington]*, 13 (1915), No. 3, pp. 479, 480).—Attention is called to a fungus thought to be identical with *Ganoderma tumidum*, attacking as a rule mature, but also sometimes young, palm trees in the Belgian Congo. The fungus may persist after the death and disintegration of the tree. It is suggested that all diseased trees be totally destroyed and the affected area surrounded by a trench 2 ft. deep and treated with freshly slaked lime.

Septoria disease of chrysanthemum, R. LAUBERT (*Handelsbl. Deut. Gartenbau*, 39 (1915), pp. 17, 18; *abs. in Ztschr. Pflanzenkrankh.*, 25 (1915), No. 2, p. 118).—Besides noting a severe local attack of *S. chrysanthemella* on *C. indicum* in Zehlendorf in December, 1914, the author discusses the previous distribution and developmental conditions of this disease.

Causation and control of breaking sickness in tulips, C. HAMMARLUND (*Meddel. Centralanst. Försökt. Jordbruksområdet*, No. 105 (1915), pp. 23, pl. 1, figs. 5; *K. Landtbr. Akad. Handl. och Tidskr.*, 54 (1915), No. 2, pp. 89-109, pl. 1, figs. 5).—Giving an account of studies on tulips, which, after blooming normally, suddenly developed a break in the stem, the author claims that the trouble is due to means used to force development. Measures recommended to prevent the weakness are avoidance of very close planting, of excessive watering, and of a close, damp atmosphere in the hothouse.

Pathological observations on the chestnut in southern Indiana. J. R. WEIR (*Ann. Rpt. Ind. Bd. Forestry*, 15 (1915), pp. 140-163, figs. 8).—The author has investigated the conditions in regard to the chestnut tree in southern Indiana for several years, primarily with reference to the chestnut bark disease, but information is given regarding the presence and habits of a large number of other fungi, mostly saprophytic, on chestnut, the chestnut blight fungus (*Endothia parasitica*) not having been found by him. A large amount of other information is presented regarding the forest growth.

The white pine blister rust. P. SPAULDING (*U. S. Dept. Agr., Farmers' Bul.* 742 (1916), pp. 15, pl. 1, figs. 5).—A popular account is given of the white pine blister rust due to *Cronartium ribicola*, and the life cycle of the fungus through its host plants, white pines, currants, and gooseberries, is described. This disease, which has been introduced into this country from Europe, has spread rather extensively, 12 distinct new outbreaks having been observed in 1915. Suggestions are given for the control of the disease and the need of adequate state laws for its control is pointed out.

[Root disease of Para rubber], W. H. JOHNSON (*Rpts. Agr. Depts. North. and South. Provs. [Nigeria]*, 1914, pp. 24, 31).—This report of the director contains an account of an outbreak of root disease in 1914 due almost exclusively to *Polyporus lignosus*, *Hymenochaete noxia* having been apparently eliminated by the removal in 1912 of all stumps known to be susceptible thereto.

A new disease in the Para rubber plantation at Calabar is due to a fungus believed to be *Ustilina zonata*, which in Ceylon causes a root disease of tea. The necessity for removal of the stumps is indicated.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A systematic account of the prairie dogs. N. HOLLISTER (*U. S. Dept. Agr., Bur. Biol. Survey, North American Fauna No. 40* (1916), pp. 36, pls. 7, figs. 2).—The so-called prairie dogs (*Cynomys* spp.) are divided into two general classes, (1) the black-tailed prairie dogs which form the subgenus *Cynomys*, consisting of three forms of two species, and (2) the white-tailed prairie dogs which form the subgenus *Leucocrossuromys*, consisting of four forms of three species. Prairie dogs are distributed over a large part of the Great Plains and Rocky Mountain regions and are of considerable economic importance, due mainly to their destruction of grasses and other forage plants.

Entomology. A. W. MORRILL (*Arizona Sta. Rpt.* 1915, pp. 563-565).—The work with the harvester ant (*Pogonomyrmex barbata*) was continued during the season of 1915. Where 28.5 lbs. of London purple were required per acre in 1914 (*E. S. R.*, 33, p. 57) only 2.5 lbs. were required in 1915 in the work of cleaning up the remnants of the old nests. The experiment shows that when once brought under complete control, the ants can be held to a point where they do no damage at a total cost each year of less than 40 cts. an acre.

Brief mention is also made of the work with the green June beetle (*Allorhina mutabilis*) and the clover or alfalfa seed chalcid fly. A trap larder experiment with the latter, though carried on under unfavorable conditions, appears to have shown definite results.

Entomological investigations, 1915. L. CHILDS (*Oregon Sta., Rpt. Hood River Sta.*, 1915, pp. 47-61, figs. 2).—The investigations here reported relate largely to the fruit tree leaf roller (*Archips argyrospila*) and to codling moth control work in 1915.

In experimental control work with *A. argyrospila* the best results were obtained from the use of lead arsenate at the rate of 6 lbs. to 50 gal. of water. Miscible oil also gave highly satisfactory results, and while more expensive

"the marked increase in efficiency attained with the oil more than warrants its use. For complete safety to the foliage, the oil applications should be made before the buds burst. Apparently no permanent injury occurred in our experimental plats this season from the late applications, but the margin of safety is extremely small and such a procedure should not be generally followed."

Codling moth infestation was very severe during 1915 throughout the entire Northwest, the loss from this source in the Hood River Valley being about twice that of 1914. In response to inquiries relative to the advisability of mixing the arsenate of lead with the fungicides, investigations were conducted with arsenate of lead in combination with lime-sulphur and iron sulphid, lime-sulphur and atomic sulphur, lime-sulphur and barium tetrasulphid, and with milled sulphur and Bordeaux mixture. In no case was the efficiency of the poison decreased.

It was found that during the year the greater percentage of worms entered the fruit through the side rather than at the calyx end. Experiments conducted show clearly that one application, whether it be the "calyx" or the one preceding the hatching of the eggs, will not control the moths. The station recommends two different schedules of sprays for the season of 1916. "The first two applications will be the same in both cases—that is, the calyx and '30-day' spray for the control of the first brood of worms. Where a loss of not more than 8 per cent was experienced in 1915, one well-timed summer spray should prove very effective in controlling the second generation. This should be applied in early August. The date will be dependent upon weather conditions. . . . Where the infestation during 1915 was found to be more than 8 or 10 per cent, two summer applications should be made to control the codling moth. The third spray should be made about July 20 and the fourth toward the middle or last of August."

Observations relating to the woolly aphid and strawberry root weevil are also briefly noted.

The locust borer (*Cyrtene robiniae*) and other insect enemies of the black locust, H. GARMAN (*Kentucky Sta. Bul.* 266 (1916), pp. 99-135, pls. 22, fig. 1).—The data here presented have previously been noted from another source (E. S. R., 35, p. 355).

Two troublesome pests of man, R. D. WHITMARSH (*Mo. Bul.* Ohio Sta. 1 (1916), No. 7, pp. 221-224, figs. 2).—Brief accounts are given of chiggers and sandflies and methods of prevention and control.

Aleyrodidae, or white flies attacking the orange, with descriptions of three new species of economic importance, A. L. QUAINANCE and A. C. BAKER (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 12, pp. 459-472, pls. 6, figs. 31).—This paper brings together information on the distribution and food plants of the white flies which attack citrus plants, 16 in number, of which 3 of economic importance are described as new to science, namely, *Aleurocanthus citripedus* from Ceylon, India, and Java; *A. scogloni* from India, Ceylon, Cuba, Jamaica, the Bahamas, and the Philippines; and *Aleurothrixus porteri* from Chile and Brazil.

A list of 20 references to the literature cited is included.

Studies of life histories of leafhoppers of Maine, H. OSBORN (*Maine Sta. Bul.* 248 (1916), pp. 53-80, pls. 5, figs. 8).—This bulletin presents the results of studies made during the summer of 1914 in continuation of those begun in 1913 and previously reported upon (E. S. R., 33, p. 356).

A chemical analysis made of timothy by the station chemist indicates that the leafhoppers not only reduce the quantity but lessen the food value of the crop attacked.

Eight species are here considered, namely, *Cicadula sexnotata*, *Acocephalus albifrons*, *A. striatus*, *Chlorotettix unicolor*, *Idiocerus provancheri*, *Draculacephala angulifera*, *Phlepsius apertus*, and *Balclutha punctata*, of which the first three mentioned are dealt with at some length. The six-spotted leafhopper (*C. sexnotata*), one of the first to invade new fields, produces several generations and is quite migratory in habit. After this, for Maine, *Deltocephalus minki* appears to be one of the earliest to appear in open fields, and later the froghoppers and *A. striatus* come in abundance. One of the latest and perhaps the least migratory is *A. albifrons*, termed the timothy crown leafhopper, since it lives down in the ground around the crowns of timothy.

The army worm in New York in 1914 (*Leucania unipuncta*), H. H. KNIGHT (*New York Cornell Sta. Bul.* 376 (1916), pp. 751-765, pls. 8).—Next to the serious outbreak of the army worm in 1896, studies of which were made by Slingerland (E. S. R., 9, p. 365), the outbreak in 1914 was the most serious that has occurred in New York State. This outbreak afforded an opportunity to gather considerable additional data, which are here reported.

The observations relate to food plants, place of development in Genesee County, life cycle, occurrence in 1915, natural enemies and methods of control, and the occurrence of an allied species, *L. pseudargyria*.

Comparative study of the amount of food eaten by parasitized and non-parasitized larvæ of *Cirphis unipuncta*, D. G. TOWER (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 12, pp. 455-458).—In the author's experiment with the parasite *Apanteles militaris* it was found that the parasitized army worm ate approximately half as much as unparasitized larvæ during the same periods, and it seems conclusive that parasitism by *A. militaris* is directly beneficial in the generation attacked. "From the results obtained it might seem as though larvæ oviposited in at an earlier date would eat more before being killed, but the time spent in the host by the parasites seems to be fairly constant, and this was also noticed in a larger number of cases in former experiments with *A. militaris*. Hence, it is believed that in such cases the larvæ would have only approximately the same amount of time for feeding, and a larger portion of this period would occur during the earlier stages, when a much smaller amount of food is eaten, so that the amount eaten would be less than the normal for unparasitized larvæ."

The clover leaf tyer (*Ancylis angulifasciana*), H. A. GOSSARD (*Ohio Sta. Bul.* 297 (1916), pp. 427-443, pls. 2, figs. 2; abs. in *Mo. Bul. Ohio Sta.*, 1 (1916), No. 6, pp. 181-185 figs. 2).—The author reports observations made of this insect since 1905, in the spring of which year his attention was drawn to the ragged, eaten condition of the clover leaves. Considerable damage was caused to clover at the station farm. Its appearance in injurious numbers seems to have been local, since the author has not observed it to be of importance elsewhere than at Wooster.

Red clover and alsike are said to have been very freely attacked in the field, white clover less commonly, and alfalfa not at all. Clover foliage eaten by the caterpillars presents a ragged appearance, the epidermis from one of the surfaces being either partly or wholly eaten away, while that remaining appears thin, papery, and white, except for minute splotches and streaks of green here and there. Either the upper or lower surface will be eaten, whichever happens to be turned inward in the cell.

The moths of the first brood appear in late April or early May and are nearly all gone by May 20. The eggs were found to require an incubation period of from two to three weeks. Three broods were observed.

"It is apparent that the first clover harvest, coming in late June and early July or earlier, will carry to the mow many of the larvæ and pupæ of the first

brood and that the second cutting will take off most of the second brood pupae. Fall pasturage will destroy many of the third brood. Plowing old clover stubble in the spring preparatory to planting corn practically exterminates all larvae in the field. The present well-established customs for harvesting and pasturing clover furnish a logical and effective program of control."

Effect of Roentgen rays on the tobacco, or cigarette, beetle and the results of experiments with a new form of Roentgen tube. G. A. RUNNER (*U. S. Dept. Agr., Jour. Agr. Research*, 6 (1916), No. 11, pp. 383-388).—This is a report of studies conducted in continuation of those previously noted (E. S. R., 29, p. 359).

"Under laboratory conditions, tests made with a Roentgen-ray tube permitting a high-energy input and giving an intense and powerful radiation gave results which promise that the X-ray process may be successfully used in treatment of cigars or tobacco infested with the tobacco, or cigarette, beetle. Heavy dosages must be given, as is indicated by the exposure given in the series of experiments tabulated in this paper. In treatment of the egg stage, heavier exposures are required to sterilize eggs which are near the hatching point than are required to sterilize eggs newly laid. In experiments performed by the writer a dosage equivalent to 150 milliamperere minutes exposure with a spark gap of 5.5 in. gave satisfactory results with eggs in tobacco placed 7.5 in. from the focal spot of the tube. With this exposure the eggs in which embryonic development was well advanced hatched, but in all cases where these larvae were kept under observation they failed to reach the adult stage. The minimum lethal dosage at a given distance from the focal spot of the Roentgen tube used has not been determined.

"In two separate experiments adults were given an exposure of 600 milliamperere minutes (amperage \times time), with a spark gap of 5.5 in., giving an approximate voltage of 65,000, with humidity at 57. The distance from the focal spot of the Roentgen tube was 7.5 in. The results are as follows:

"(1) No effect on length of life was apparent, as the beetles died at about the same rate as the same number of beetles kept as a check. (2) Large numbers of eggs were deposited after exposure. These eggs were infertile. Eggs laid by the check beetles hatched normally.

"Larvæ were given an exposure of 600 milliamperere minutes, other conditions of the experiment being the same as in the experiments with adults given above. While no immediate effect was apparent, the treatment had the effect of stopping activity and development, the larvæ remaining in a dormant condition for a prolonged period. All treated larvæ died before reaching the pupal stage."

The alfalfa weevil and methods of controlling it. G. I. REEVES, P. B. MILES, T. R. CHAMBERLIN, S. J. SNOW, and L. J. BOWER (*U. S. Dept. Agr., Farmers' Bul.* 741 (1916), pp. 16, figs. 7).—A popular summary of knowledge of this insect and means for its control.

Cotton boll weevil control in the Mississippi Delta, with special reference to square picking and weevil picking. B. R. COAD (*U. S. Dept. Agr. Bul.* 382 (1916), pp. 12).—In plat tests of five square pickings at 7-day time intervals an increase of 23 per cent over the check was obtained. Tests of seven weevil pickings with the bag-and-hoop indicated similar results. Comparative observations on different methods of collecting weevils demonstrated the great superiority of the bag-and-hoop over hand picking so definitely that there should be no question as to which method to follow. The margin of profit to be derived from these two control measures seems to be too slight to allow their operation on a wage basis. For this reason the only condition under which they should be attempted is on tenant cotton where the work can be performed without any direct outlay for labor.

House ants: Kinds and methods of control, C. L. MARLATT (*U. S. Dept. Agr., Farmers' Bul. 740* (1916), pp. 12, figs. 5).—This is a more extended account than that previously noted (*E. S. R.*, 10, p. 654).

FOODS—HUMAN NUTRITION.

The iodine content of foods, E. B. FORBES (*Mo. Bul. Ohio Sta.*, 1 (1916), No. 7, pp. 219, 220).—The author concludes from his study of the iodine content of various foodstuffs that iodine is a comparatively unusual food constituent, and that its presence is commonly accidental in the sense of standing in no essential relation to the growth of the food products. Variations in the iodine content of foods were not successfully related to any associated conditions. No consistent or orderly geographic distribution of iodine in foods was revealed, nor were there noticeable effects of the type of soil or method of fertilization on the iodine content of foods. The iodine content of samples of the same crop from different plats of the same field sometimes varied greatly.

The relation of certain physical characteristics of the wheat kernel to milling quality, C. H. BAILEY (*Jour. Agr. Sci. [England]*, 7 (1916), No. 4, pp. 332-342).—The investigations here reported indicate that, with the same type and variety of wheat, kernel volume, because of its relation to the ratio of endosperm to nonendosperm structures, varies directly with the potential flour yield.

"Accurate determination of kernel density must include the complete removal of all mechanically held air. Large kernels, other things being equal, have a higher specific gravity than small kernels of the same variety, indicating the endosperm to have a higher specific gravity than the bran and germ.

"Relative density of the endosperm is generally conceded to be dependent upon the proportion and size of the air vacuoles. Soft, light-colored, yellow-berry kernels have a lower specific gravity than hard, dark-colored kernels of the same variety. The more dense the endosperm, other things being equal, the greater the ease of, and the more complete, the separation of endosperm from bran and germ in milling.

"Wheat kernels of a high specific gravity have a higher nitrogen content as a usual thing than less dense kernels of the same relative size or volume.

"Hard red wheats grown in the northern Great Plains area, while varying widely, have a higher average specific gravity than do the soft red winter wheats grown in the eastern half of the United States."

Milling and baking tests on Argentine and Walla wheats, P. R. SCOTT and F. G. B. WINSLOW (*Jour. Dept. Agr. Victoria*, 13 (1915), Nos. 11, pp. 661-666, fig. 1; 12, pp. 736-739).—These tests of wheats imported from Argentina and the Pacific Coast States of this country indicated that, as compared with Australian wheats, the flour produced was lacking in bloom and the dough required a longer time to prove and lacked the power to produce as good loaves. When blended with a moderate percentage of Australian wheat flour, good loaves were obtained.

A method of making bread, G. CORNALBA (*Bul. Agr. [Milan]*, 50 (1916), No. 27, p. 1).—This article describes a system of bread making which utilizes all of the substance of the grain. The grain is submitted to germination for from 30 to 60 hours, macerated to soften it, ground, mixed with yeast and salt, and then made into a dough. This dough is made homogeneous, divided into loaves weighing about 50 gm., and baked in the usual manner.

The bread is said to have a very dark color, a rough crumb, a heavy crust, and an agreeable and pronounced taste. One hundred kg. of the wheat give about 135 kg. of bread containing about 35 per cent of water, which makes the

weight of the bread a little greater than that of the wheat. It is stated that this system of bread making has the further advantage of utilizing nutritive material which is lost in other methods—e. g., protein, phosphoric acid, lecithin, phytin, organic phosphorus compounds, magnesium salts, and diastatic ferments.

Some factors affecting the cooking of dholi (red gram or pigeon pea) (*Cajanus indicus*), B. VISWANATH, T. L. ROW, and P. A. R. AYYANGAR (*Mem. Dept. Agr. India, Chem. Ser., 4* (1916), No. 5, pp. 149-163, pl. 1, fig. 1).—The factors which were studied with reference to their influence upon the rate of cooking of dholi (*C. indicus*) included the composition of the water, the fat content, the variety, and the method of preparation. The results of the investigation are summarized in part as follows:

"Dissolved salts, such as are found in natural waters, exert a marked influence on the time taken to cook dholi. Calcium and magnesium salts and the chlorides of hydrogen and sodium exert a strong retarding effect, whereas alkalis and alkaline carbonates have the reverse action. Whether the action exerted by any salt is a retardation or an acceleration, the effect is approximately proportionate to the concentration, i. e., the harder the water the slower is the rate of cooking. The addition of sodium bicarbonate or sodium carbonate to a hard water materially hastens the cooking.

"The rate of cooking of dholi is approximately proportionate to the rate of solution of the dholi substance—i. e., to the rate of solution of the protein and starch. The proportion of protein to starch dissolved is not constant but varies with different solutions. Alkalis and alkaline carbonates dissolve a greater proportion of protein than starch as compared with pure water, whereas hydrochloric acid dissolves a greater proportion of starch. In addition, alkalis and alkaline carbonates greatly accelerate the rate of cooking.

"The rate of solution of the protein appears to be the factor which mainly controls the rate of cooking. . . . The fat content plays a very unimportant part. . . . Dholis of different localities have varying rates of cooking."

In connection with the investigation a study was made of the influence of different salts on the liquefaction of pure starch.

Cultivation and canning of mangoes in India, T. C. CHAUDHURI (*Jour. Indus. and Engin. Chem., 8* (1916), No. 7, pp. 618, 619).—The author discusses briefly the use of mangoes as food, methods of cultivation, and the problems involved in preserving the fruit.

Case of poisoning by daffodil bulbs (*Narcissus pseudo-narcissus*), W. G. McNAB (*Pharm. Jour. [London], 4, ser., 42* (1916), No. 2738, pp. 367, 368).—In this article and its discussion, references are made to several cases of food poisoning caused by eating the bulbs of the common daffodil, these being mistaken for onion and used in the preparation of stews. Severe gastro-intestinal disturbances were experienced but no deaths resulted. It is stated that daffodil bulbs contain an alkaloid whose physiologic action differs according to the stage of growth of the plant.

The investigation of some cases of cheese poisoning, G. SPICA (*Atti R. Ist. Veneto Sci., Let. ed Arti, 69* (1909-10), pt. 2, pp. 685-691).—Cases of food poisoning attributed to cheese are reported. Four samples of the cheese in question were examined. Extraction with water and ether yielded a substance of unknown chemical composition which was toxic to frogs.

The soy bean and condensed milk in infant feeding, J. RONAÏH (*Amer. Jour. Med. Sci., 150* (1915), No. 4, pp. 502-512).—The author reports the results of clinical experience and concluded that the soy bean, condensed milk, and some cereal (as a source of additional carbohydrate) in proper proportions may be used without danger.

On the composition of human milk in Australia.—I, The composition during the early stages of lactation, H. S. H. WARDLAW (*Jour. and Proc. Roy. Soc. N. S. Wales*, 49 (1915), pt. 2, pp. 169–198, fig. 1).—In this extensive investigation a study was made of the composition of 105 samples of human milk obtained during the first 10 or 11 days after childbirth.

In addition to determining the most probable composition of human milk, it was the object of the author to determine the effect of a number of factors upon its composition. It was found that certain values of the percentages of constituents other than fat occurred more frequently than others. These were total solids, 12.8 per cent; solids not fat, 9.8 per cent; protein, 1.9 per cent; solids not fat and not protein, 7.6 per cent. The percentages of fats vary widely, the average content being 3.11 per cent. "The average percentage of fat increased from 2.84 to 4.13 during the first 11 days of suckling; the average percentage of protein decreased from 3.3 to 1.60 during the same period.

"The age of the woman, the number of pregnancies, the volume of the sample, the time since the last withdrawal of milk from the breast, and the breast from which the sample was taken appeared to have no distinct effect on the composition of the milk examined."

A bibliography of cited literature is appended.

Bulletin of the inspection of foods and beverages in Surinam.—Fish Analyses, J. SACK (*Kcuringsdienst Ect- en Drinkwaren Suriname, Bul. B* (1916), pp. 34).—Data are given showing the percentage composition of the edible portion and the cost of a number of kinds of fish.

The percentage of alcohol in homemade root beer, C. H. LA WALL (*Amer. Jour. Pharm.*, 88 (1916), No. 8, pp. 355–358).—The homemade root beer, prepared according to directions, was found to contain 0.25 per cent of alcohol after standing 2 days and 1.52 per cent after standing 11 days. No higher alcoholic content was observed after the beer had stood for 19 days longer. If the fermenting liquor was allowed to stand 3 hours before bottling and the bottles were only partially filled, the alcoholic content rose more rapidly, and the highest amount noted was 1.77 per cent.

The inhibiting action of certain spices on the growth of micro-organisms, FREDA M. BACHMANN (*Jour. Indus. and Engin. Chem.*, 8 (1916), No. 7, pp. 620–623, figs. 2).—The organisms studied in this investigation were pure cultures of species of the common molds, *Rhizopus*, *Penicillium*, *Aspergillus*, and *Alternaria* (which are frequently found on spoiled preserves), and pure cultures of *Bacillus coli*, *B. prodigiosus*, and *B. subtilis*. The spices tested were added in some form to the nutrient agar in which the bacteria or molds were grown. Studies were made of the effect of alcoholic extracts of spice, ground spice, spice and vinegar, cinnamic aldehyde and eugenol (the active principles of cinnamon and cloves), the oils of allspice and nutmeg, and the oleoresin of black pepper.

The author states that "it does not appear from the extent of the present study that spices as used in the kitchen in the usual amounts for flavoring purposes in spiced cakes exert a very considerable preservative effect. Where cinnamon, cloves, and allspice are used in large amounts, the growth of molds may be retarded. In spiced fruit where a large amount of the spice is used, the preservative effect may be much greater. This effect may be greater, too, when the spice is combined with vinegar."

It is suggested that cinnamic aldehyde and possibly other active principles might be used in such proportions as to prevent the growth of micro-organisms and yet in small enough quantities not to spoil the flavor of the product.

"Pepper and nutmeg have little effect on the growth of micro-organisms. A mixture of nutmeg and water boiled for a half hour and left exposed to the air for chance inoculation was covered with various molds in less than a week. Cloves and allspice in large amounts are quite effective in preventing the growth of molds and bacteria, and cinnamon is the most effective of the spices; this is true of the ground spices, their essential oils, and the alcoholic extracts."

The dairy and pure food laws of the State of Connecticut ([*Hartford, Conn.*]: *Office Dairy and Food Comr.* [1916], pp. 52).—The text of the laws is given as corrected to the close of the legislative session of 1915.

[Food and drug analyses], J. P. STREET ET AL. (*Connecticut State Sta. Rpt.* 1915, pt. 5, pp. 265-419).—This report presents the results of the analysis of 2,220 samples of foods and drugs, of which 1,081 were not adulterated. The food products examined included cereal breakfast foods, cheese, cocoa and chocolate preparations, coffee, coffee substitutes, diabetic foods, fig preparations, flavoring extracts, canned fruits, infant foods, sirups, etc. Full analytical data are given regarding each of the samples analyzed. The drug products examined included standard drug preparations and proprietary medicines.

Bulletin of the inspection of foods and beverages in Surinam.—Analyses of common foods, J. SACK (*Keuringsdienst Eet- en Drinkwaren Suriname, Bul. C* (1916), pp. 12).—In this bulletin analytical data are reported concerning the composition of some well-known meats, vegetables, and fruits.

Rates for electric cooking and water heating (*Jour. Electricity*, 37 (1916), No. 1, pp. 12, 13).—The question of proper rates for this class of service is discussed and the rates of several western companies are given as illustrations.

Canning in glass in the home (fruits, vegetables, and meats), SARAH E. BELT (*Agr. of Mass.*, 63 (1915), pt. 2, pp. 49-57).—General information and specific directions are given for the canning of fruits, vegetables, and meats.

Interim report of the departmental committee appointed by the president of the board of agriculture and fisheries to consider the production of food in England and Wales, MILNER ET AL. (*London: Govt.*, 1915, pp. 7).—A number of measures are recommended for increasing the present production of food, on the assumption that the war may be prolonged beyond the harvest of 1916.

Food economics, G. LUSK (*Jour. Wash. Acad. Sci.*, 6 (1916), No. 12, pp. 387-396).—This lecture presents statistical data showing the amount of protein and the fuel value of food consumed by people living under extremely varied conditions.

It also includes a brief statement of the results of a dietary study by F. C. Gephart, carried out at a private boarding school for boys having 555 students, in which determinations were made of the food supplied per meal, the proportion of the total number of calories furnished by the different foods, the cost of the food, and the amount of waste. The author states that the growing athletic boys in this school were not satisfied with 3,000 calories daily, but took 4,570 calories daily at the table and also bought 650 additional calories at a neighboring store. In his opinion these results show that active boys eat more food than is realized and that their ravenous appetite is due to the muscular work involved in their play and that "lack of appreciation of this factor and lack of provision for it are the probable causes of much of the undernutrition seen in children of the school age."

The importance is emphasized of including on the label a statement of the number of calories furnished by packages of foods.

Conditions of diet and nutrition in the internment camp at Ruhleben, A. E. TAYLOR (*London: Govt., 1916, pp. 12*).—The data presented in this report are based on a 7-day study of the dietary in the camp.

The following requirements are given for a complete, sufficient, and normal diet: "It must contain protein sufficient in amount and representative in component amino acids to maintain the tissues and cells of the body in a state of normal composition and function. . . . It may be stated that from 70 to 90 gm. of protein per day are fully competent to maintain normal nutrition in the adult male (not engaged in hard work), provided that the proteins offer the body all the needed amino acids and that the diet is rich in carbohydrate."

The diet should also contain a sufficient amount of fuel (largely in the form of carbohydrate) to furnish at least 30 calories per kilogram of body weight per day. It must contain from 25 to 50 gm. of fat per person per day, the various salts required in the body, and certain unknown substances grouped under the term "vitamins," and it should not consist entirely of preserved or conserved foodstuffs.

In addition, the author lays considerable emphasis on the fact that the diet to be entirely adequate must take into some account the habits, tastes, and customs of the persons fed. It is pointed out that diets tolerated under normal conditions may become intolerable under conditions of confinement and that monotony of the diet should be avoided, since it may lead to reduced appetite and consequently impaired nutrition. Monotony of the diet is less noticeable if it is one to which the individual has been accustomed.

As a result of this investigation a number of changes in the diet of the camp are recommended and embodied in this report.

Review of the literature on the metabolism of normal infants, W. McK. MARRIOTT (*Amer. Jour. Diseases Children, 12 (1916), No. 1, pp. 88-102*).—In this summary and digest of data the results obtained by a number of investigators on different phases of this subject are brought together. Most of the material has been previously noted from the original sources.

The question of cellulose digestion, W. ELLENBERGER (*Hoppe-Seyler's Ztschr. Physiol. Chem., 96 (1915), No. 3, pp. 236-254*).—A preliminary note discussing the factors which influence cellulose digestion.

The antiseptic action of the gastric juice, J. P. GREGERSEN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 77 (1916), No. 4, pp. 353-361*).—The object of these experiments was to determine the influence of the acidity of the gastric juice upon its bactericidal action and whether or not any other factors were involved. Samples of the gastric contents were obtained from a number of individuals 45 minutes after the ingestion of an Ewald test meal (35 gm. of toast and 250 gm. of water), the acidity of the contents measured by titration, and the bactericidal property determined, *Staphylococcus pyogenes aureus* being the organism used. In some of the samples different degrees of acidity were secured by the addition of hydrochloric acid or sodium hydroxide before determining the bactericidal property.

It was found that the bactericidal power of the stomach contents varied directly as the amount of free acid present and was not influenced by the combined acidity or the amount of pepsin present. The bactericidal action of the gastric juice was from 3 to 4 times as strong as corresponding strengths of the pure acid in water.

The presence and significance of molds in the alimentary canal of man and higher animals, G. TURESSON (*Svensk Bot. Tidskr., 10 (1916), No. 1, pp. 1-27*).—This article reports the results of the isolation and investigation of molds in samples of feces from 13 different persons, two of whom were vegetarians. In addition to determining the species present investigations were

made of the action of temperature and gastric juice upon the spores of *Penicillium* and *Aspergillus* and the pathogenic properties of molds isolated from human and animal feces by means of intravenous injections and feeding experiments made on laboratory animals.

In summarizing the results of the investigation, the author states in part that "the occurrence of fungi in the alimentary canal of man has been proved to be more frequent than was formerly supposed. In analyzing samples of human feces the following molds were isolated: *A. fumigatus*, *A. flavus*, *A. niger*, *A. nidulans*, *A. umbrinus*, *A. terreus*, *P. divaricatum*, *Oidium lactis*. In addition numerous yeasts were found. . . .

"The temperature modifies the toxic action of the gastric juice in this way: An increase in temperature above the optimum for the fungus increases the toxicity of the juice to the species. Molds with low optima are, therefore, killed when passing through the alimentary canal, while thermophilous species pass through alive. Accordingly, only molds with comparatively higher optima are found in feces of warm-blooded animals while feces of cold-blooded animals yield molds with low optima as well.

"Intravenous injections in rabbits of *A. terreus*, *A. umbrinus*, and *P. divaricatum* showed no pathogenic properties of these molds.

"Feeding of spores and mycelium of *A. fumigatus*, *A. flavus*, *A. niger*, *A. nidulans*, *A. umbrinus*, *A. terreus*, *P. arachnaceum*, and *P. divaricatum* to rabbits proved to be fatal. The symptoms of poisoning from the toxic molds were muscular convulsions resembling tetanus, weakness, and paralysis, followed by death.

"An accumulation of molds in the alimentary canal of man may lead to serious disturbances and should, therefore, receive due attention."

A bibliography of cited literature is appended.

Chemical changes in the central nervous system as a result of restricted vegetable diet. MATHILDE L. KOCH and C. VOEGTLIN (*Pub. Health Serv. U. S., Hyg. Lab. Bul.* 103 (1916), pp. 5-49, figs. 12).—The small amount of experimental data available regarding the chemical changes produced in the central nervous system as the result of changes in diet shows that underfeeding with a mixed diet leads to no marked changes except a high variation in the water content, that starvation does not appear to change the composition of the brain, and that an exclusive diet of polished rice leads to a decrease in the amount of nitrogen and phosphorus in the brains of pigeons.

In this investigation six laboratory animals (monkeys) were fed upon the following diets: (a) Corn-oil cake, a substance poor in vitamin; (b) equal parts of corn meal and sweet potatoes, a diet rich in carbohydrates and poor in protein and fat; (c) corn meal; and (d) raw carrots. From a comparison of the chemical composition of the encephalon and spinal cord of these six monkeys with the composition of the encephalon and spinal cord of a normal monkey maintained on a mixed diet as a control, the following conclusions are drawn:

"Chemical changes in the brain and cord are observed in animals (monkeys and rats) as the result of an exclusive vegetable diet of various composition.

Histological examination of the central nervous system of these animals reveals extensive degeneration of many nerve tracts in the spinal cord, very similar to those found in pellagra.

In some of the animals the chemical changes are practically identical with the changes observed in pellagra. These findings therefore yield additional evidence for the theory that pellagra is a dietary disease."

Chemical changes in the central nervous systems in pellagra. MATHILDE L. KOCH and C. VOEGTLIN (*Pub. Health Serv. U. S., Hyg. Lab. Bul.* 103 (1916),

pp. 51-129, pls. 2, figs. 3).—In this report the work of other investigators on the subject is briefly reviewed, and a short summary of the present-day knowledge of the chemical constituents of the nervous system is given. The analytical methods employed are described in detail. A comparison of the chemical analysis of the central nervous system in five cases of uncomplicated pellagra, as compared with the chemical analysis of normal controls, showed that in pellagra the central nervous system is subject to a series of chemical changes involving, principally, certain lipoids.

ANIMAL PRODUCTION.

The production coefficients of feeds, G. S. FRANKS (*Texas Sta. Bul. 185 (1916), pp. 5-16*).—It is stated that the value of a feeding stuff consists in its volume, which satisfies the appetite of the animal, its digestible protein, which furnishes material for muscular and other similar tissue, and its productive value, which represents its value for the purpose of supplying energy for work, or bodily activities, heat, or material for the production of fat, etc. This bulletin describes a method of calculating the productive values of feeds from their chemical composition.

The productive value of a feed is defined as the amount of fat that the feed will produce upon a fattening animal, when it is fed in addition to a basal ration already sufficient for the bodily needs of the animal. The author prefers to express the productive value in terms of fat for the reason that it represents as nearly as is possible the exact substance measured in the experiments, and does not involve any assumption as to the quantity of productive energy consumed in forming fat, or other similar assumptions. Knowing the composition and coefficients of digestibility the productive value in terms of fat of a given feeding stuff may be calculated, but in order to simplify the calculation it is proposed to use a factor to be known as the production coefficient. This is defined as the factor which, multiplied by the percentage of the nutrient, gives the productive value of that nutrient in terms of fat.

As the production coefficient is calculated from the coefficient of digestibility, anything that will affect the digestion will also affect the production coefficient. Also, some feeds may be regarded as mixtures of two or more constituents which have different coefficients of digestibility and different production values. Cotton-seed meal, for example, may be considered as composed of cotton-seed kernel residue and cotton-seed hulls, and the amount of cotton-seed hulls may be calculated from the amount of crude fiber present. Since cotton-seed kernels and cotton-seed hulls have different production coefficients, the quantity of crude fiber will thus affect the production coefficient of the feeding stuff.

There are similar variations in the composition of other feeding stuffs which are related to different constituents having different digestive coefficients and different productive values. These are problems which are under study.

A table is given which shows the production coefficients of a number of feeds, based upon the average coefficients of digestibility. A column is included which shows the method of correction used for the crude fiber, or nitrogen-free extract, or both, as the case may be.

[Feeding stuffs], F. A. CROWES (*Hawaii Sta. Rpt. 1915, pp. 51-53*).—Bonohono (*Commelina nudiflora*) is described as an extremely succulent feed, much relished by cattle. Cattle fatten and produce an abundance of milk when pastured where it is plentiful. The total yield of green feed per acre, calculated from an experimental plot 10 ft. square, was 223.6 tons. Per acre production it compares very favorably with green alfalfa both in protein and in other food constituents.

It is stated that as a pasture grass *Paspalum dilatatum* has given excellent results. Its strong deep root system enables it to withstand the trampling of stock in wet weather better than any other grass tested that is equally relished by the cattle.

Cane-top silage has proved of value in feeding operations. Some of the cane tops were cut two weeks before they were put into the silo. Notwithstanding the resulting staleness and the excessive amounts of water that went into the silo during filling, the silage was of fair quality and was eaten readily by the cattle and horses. The yield of cane tops per acre is about 10 per cent of the weight of the usable cane, and on the unirrigated plantations this by-product would run from 4 to 8 tons of cane tops per acre.

Commercial feeding stuffs, 1915, J. P. STREET ET AL. (Connecticut State Sta. Rpt. 1915, pt. 4, pp. 233-264).—Analyses are given of the following feeding stuffs: Cotton-seed meal; linseed meal; wheat bran, middlings, and shorts; cracked corn meal; corn gluten meal; corn gluten feed; hominy feed, dried brewers' grains; dried distillers' grains; dried beet pulp; mangels; coconut meal; peanut meal; oats; provender; alfalfa; alfalfa meal; cracker wastes; and various mixed and proprietary feeds.

Facts for the feed buyer, W. H. STROWD (Wisconsin Sta. Bul. 267 (1916, pp. 36).—Information regarding feeding stuffs is summarized, and analyses are given of the following: Cotton-seed meal, linseed meal, gluten feeds, corn oil meal, distillers' grains, hominy feed, corn germ meal, wheat bran and middlings, red dog flour, germ middlings, oatmeal and rye middlings, barley shorts, buckwheat bran, malt sprouts, dried brewers' grains, dried malt grains, alfalfa meal, blood and meat meal, meat scrap, bone products, tankage, ground peas, flax shives, silage, soy bean hay, and various mixed and proprietary feeds.

[Nutrition investigations at the Wisconsin Station] (Wisconsin Sta. Bul. 268 (1916), pp. 36-42, figs. 2).—Notes on several studies are given.

Value of proteins from different sources [for growth], by E. V. McCollum.—Since various unbalanced proteins are not all deficient in the same amino acids, it might be expected that when two unbalanced proteins were combined the first might supplement the deficiencies of the second and better growth be made than with either alone. To study this problem young pigs were fed on many rations in which either a single feed or two or more feeds mixed in various proportions supplied the protein.

Of those tested the proteins of milk were found most efficient for growth, the pigs storing in their bodies over 60 per cent of the milk protein. The proteins of the cereal grains had an efficiency of only from 23 to 28 per cent, and of linseed meal, fed alone, only 18 per cent. However, when three-fourths of the protein in the ration came from the corn and one-fourth from linseed meal the efficiency was increased to 37 per cent. From this it is concluded that linseed meal and corn are not deficient in the same amino acids, and that when combined one tends to correct the deficiencies of the other. This agrees with the good results secured in numerous scientific trials and in practice when linseed meal is fed as a supplement to corn. On the other hand, no better results were secured when wheat and wheat embryo were combined than when each was fed separately. In this case each feed is evidently deficient in the same amino acids, and one can not supplement the other.

Value of proteins from different sources [for milk production], by E. B. Hart and G. C. Humphrey.—It has been found in metabolism experiments with dairy cows that proteins from various sources are likewise of different worth for milk production. In these trials cows were fed a basal ration of corn stover, which supplied but a small amount of digestible protein. To this ration were added

corn grain and corn by-products, or wheat grain and by-products (much of the protein of which is unbalanced in composition), or milk protein, supplied in the form of skim-milk powder and casein (furnishing proteins which are well balanced in composition).

The percentage of the digestible protein of these rations which was used by the cows for milk production and the formation of body protein was 40 per cent with the corn ration, 34 per cent with the wheat ration, and 58 per cent with the milk protein ration. Such complete proteins as are furnished by milk are thus apparently of high efficiency for milk production.

Commonly unappreciated factors in food, by E. V. McCollum.—Previous experiments (E. S. R., 31, p. 864) have demonstrated that certain fat-soluble substances found in milk fat, fats from egg yolk, corn grain, and wheat embryo, and the soft portion of beef fats are necessary in the diet for continued growth. It appears that there is also required another class of substances which are soluble in water, the nature of which has not been discovered. These substances have been found thus far in egg yolk and wheat embryo, and are probably present in corn. Growing rats fed a ration of highly purified casein, egg albumin, dextrin, mineral matter, and milk fat failed to grow. However, normal growth took place when the water extract of wheat embryo was added, which evidently supplied the necessary accessory to the diet. It has been found that neither the fat-soluble nor the water-soluble accessories are injured by heating above the boiling point of water.

Influence of strictly vegetable diets on growth and reproduction, by E. B. Hart and E. V. McCollum.—It is thought that strictly vegetable foods might be found insufficient for normal growth. To study this problem experiments were carried on with growing pigs kept in pens away from the soil and supplied in some cases with distilled and in others with natural water. On a well-balanced concentrate mixture of oats, corn, wheat, and oil meal, pigs failed to grow after about three months, even when sugar beets and alfalfa hay were supplied two or three times a week. Where but 1 per cent of meat scrap was added to the ration the pigs grew normally, reaching a weight of 250 lbs. by the time those on the strictly vegetable diet had reached 100 lbs.

Other experiments, however, showed that the missing essential constituents could be supplied in vegetable feed. In the earlier experiments uncut alfalfa hay was offered the pigs, but they consumed very little. Fifteen per cent of finely ground alfalfa meal was then mixed with the ration, so that the pigs would be forced to consume larger amounts of alfalfa. On this vegetable ration good growth occurred. These experiments indicate that the meat supplied a better-balanced protein mixture than the basal ration of grains and oil meal, and also more of the diet accessories needed for rapid growth. These accessories are also apparently present in alfalfa.

Corn silage for beef cattle, by J. L. Torney.—In six trials, each of which lasted 90 days, a total of 63 2-year-old steers were fed. In these trials the addition of silage to rations of concentrates and either alfalfa or clover hay decreased the amounts of concentrates required per pound gain, but increased the roughage requirement. In all cases the addition of the silage lessened the feed cost per pound of gain and reduced the necessary margin, although a heavy concentrate allowance with less silage produced more rapid gains. For fattening 2-year-old steers an average daily ration throughout the feeding period of 20 lbs. of corn silage, 5 lbs. of clover, alfalfa, or mixed hay, 12 lbs. of shelled corn, and 2 lbs. of cotton-seed meal, or amounts of other protein-rich concentrates furnishing an equal amount of digestible protein, is recommended.

In one of the trials steers fed an average ration of 37.6 lbs. silage, 3.1 lbs. clover hay, and only 7 lbs. concentrates (3.1 lbs. corn, 2.7 lbs. cotton-seed meal

and 1.2 lbs. wheat bran) per head daily gained 2.36 lbs. per head daily. A lot fed 13.5 lbs. concentrates (9 lbs. corn, 2 lbs. cotton-seed meal, and 2.5 lbs. wheat bran), with 28.8 lbs. silage and 3.2 lbs. clover hay, gained 2.59 lbs. per head daily. However, the feed cost of the gains of these steers fed the heavier concentrate allowance was 16 per cent higher and the margin necessary in feeding was 31 cts. greater.

Studies in animal breeding (*Wisconsin Sta. Bul.* 268 (1916), pp. 9, 10).—Studies on the effect of such poisons as lead on the germ cells of the male showed the same deleterious results as were obtained the year before (E. S. R., 33, p. 368).

Work on the inheritance of epilepsy in guinea pigs has shown that this disease is inheritable and follows Mendel's law.

In a study, carried on by H. L. Ibsen, of the growth of guinea pigs in embryo and after birth it has been observed that the weights of the different embryos in a litter show that the first and last embryos are invariably larger than those in the middle of the same horn of the uterus. It is popularly believed that the "titman" or runt of a litter of pigs is the last one to be born, but this observation would seem to indicate that such is not the case, as the smaller embryos are always found in the middle of the row of young in the uterus.

In experimental work on the influence of close inbreeding, carried on by J. G. Halpin, it is reported that with Rhode Island Reds results of a detrimental character are beginning to be observed, that the closely inbred stock takes longer to hatch and frequently does not produce so strong chicks as those from the control pens.

The influence of sires on production, C. C. HAYDEN (*Mo. Bul. Ohio Sta.* 1 (1916), No. 7, pp. 211-215, figs. 2).—Partial records were kept of the results of the use of various bulls in the station dairy herd. The first bull used on the first group of cows came from a dam which had a good official record, and the granddam on the sire's side had a record of large production. His sire was more noted as a show-ring favorite than as a sire of producing daughters. The results showed an average gain of the daughters over their dams of 1.902 lbs. of milk and 60 lbs. of fat for the first year, and an average yearly difference of 1.176 lbs. of milk and 42 lbs. of fat for all periods.

A second bull was selected for this group, the price paid being about twice that for the first bull. He had better records of production back of him, and the results justified the greater expenditure. The gain over the original dams by the use of this bull was for the first calf 4,074 lbs. of milk and 156 lbs. of fat, and for one year of all lactation periods, 4,297 lbs. of milk and 153 lbs. of fat. The gain over the daughters of the previous bull was for the first year only 2,172 lbs. of milk and 96 lbs. of fat, and for one year of each lactation period, 3,031 lbs. of milk and 111 lbs. of fat.

The first bull used on the second group was selected from one of the best herds in Ohio, though his sire and dam had no official records. A decrease of 687 lbs. of milk and 39 lbs. of fat showed that the use of this sire greatly reduced the productive capacity. His double daughters produced 3,529 lbs. of milk and 202 lbs. of fat, or a decrease of 521 lbs. of milk and 32 lbs. of fat below their dams.

The daughters of a second bull used on this group show an increase over the daughters of the first bull of 752 lbs. of milk and 32 lbs. of fat per year. For the first lactation period only they show an increase of 1,205 lbs. of milk and 49 lbs. of fat, indicating that they will be far superior to the daughters of the first bull when they are mature. At the time this second bull was purchased his ancestry had no official records, but his dam was said to be a heavy persistent milker and his sire was imported.

Sheep-breeding investigations, R. H. WILLIAMS and W. S. CUNNINGHAM (*Arizona Sta. Rpt. 1915*, pp. 554-560).—In continuation of work previously noted (E. S. R., 33, p. 73), it is reported that the Tunis sheep continued to prove themselves vigorous breeders and produce early active lambs with a marked ability to withstand heat. Their greatest fault is that the wool is very coarse, with loose crimp and too much hair, or "kemp."

Hampshire, Shropshire, Oxford, and Dorset breeds have been used to improve the mutton characteristics of the lambs, and have proved valuable for this purpose in the order named. Oxford and Dorset breeds have been eliminated because of the high rate of mortality among the lambs. More recently it has been decided to limit the Shropshire blood because of the smaller size, inferior mutton form, and lower percentage of black faces in their lambs than in those of the Hampshire crosses. Unfortunately, the Hampshire crosses are inferior in wool, having a short staple and light fleeces. The weight and quality of wool of the native sheep, which are of Merino foundation, have not been much improved by the above process.

It is thought that the ideal valley sheep must have a somewhat open fleece, while the range sheep may have a denser and longer fleece, due to their grazing in higher altitudes.

Of the breeds used the Tunis and Hampshire have brought about the greatest improvement. Lambs showing a high proportion of Tunis blood have been active, alert, and hardy, but have given poor quality of wool and are of only fair mutton conformation. The Tunis-native cross has usually resulted in tan-colored face and legs, although many mottled and white faces are found. The wool from this cross is usually of medium staple, good length, and density, but contains too much kemp. The Hampshire blood has been excellent in improving the mutton form, increasing the size, and stamping black faces on their crosses. A table is given showing the weights at different ages and the average weights of fleece for the more desirable crosses.

Data kept for three years indicate that lambs born early in the year usually reach a greater weight at six months than those dropped later. The average weight of lambs born in January was greater than that of any other month; February lambs more than March; March lambs more than April, and April lambs more than May. There was difference of 17.21 lbs. between the average weight of May lambs and those born in February. There is a general tendency for the earliest lambs to reach a larger average weight, due to the fact that there are few or no small lambs.

There has been found to be a great difference in the fineness and denseness of the wool fibers in the various crosses, and certain crosses have been more efficient than others in eliminating the characteristic Tunis hair, or kemp, from the wool. The Hampshire and Shropshire blood have aided materially in improving this fault, the former being of the greatest service.

In this study it has been noted that there is a close correlation between the fineness and the denseness of wool. In every case where a fleece is reasonably fine it is also fairly dense.

Maintenance rations for breeding flocks of mutton and wool sheep, B. O. SEVENSON (*Pennsylvania Sta. Rpt. 1914*, pp. 84-117).—Continuing previous work (E. S. R., 34, p. 171), the four lots of ewes were fed during the 216 days beginning April 19. During the summer months all of the breeding ewes with their lambs were placed on the same pasture. The lambs were allowed to suckle their dams until 16 weeks of age, and during this time they were allowed to consume as much grain as they would eat. After weaning, the ewes were placed on another pasture with no grain and the lambs were continued on

the same pasture and fed a grain ration consisting of shelled corn, oats, wheat bran, and linseed meal, 5:3:2:1. From September 12 to November 5, 1913 lbs. of the same grain mixture was fed the 38 ewes.

The average weights of the ewes during the summer months were greater for the two lots of sheep (lots 1 and 3) in which silage had been fed as the sole roughage during the preceding winter. During the entire period the average increase in weight of each ewe in lot 1 was 23.946 lbs., in lot 2, 32.158 lbs., in lot 3, 13.752 lbs., and in lot 4, 15.307 lbs. The Shropshire ewes (lots 1 and 2) thus gained practically twice as much as the Delaine-Merino ewes (lots 3 and 4). It is estimated that the average cost of keeping each ewe during the 210 days was \$2 per head, no credit being given for the value of manure produced while on pasture or the improvement that the sheep brought about by destroying the weeds.

From April 19 to August 9, the Shropshire lambs (lots 1 and 2) made average daily gains per head of 0.573 and 0.484 lb., while the Delaine-Merino lambs (lots 3 and 4) made average daily gains of 0.288 and 0.36 lb. per head. The total cost of feed was \$5.52 for 25 lambs for a period of 112 days.

During a second winter period of 154 days four lots of 10 ewes each were fed. Lots 1 and 3, consisting respectively of Shropshire and Delaine-Merino ewes of breeding age, were fed a roughage ration composed of corn silage supplemented with cotton-seed meal, and a grain mixture composed of shelled corn, oats, bran, and linseed meal, 5:3:2:1, this mixture being fed at such times and in such amounts as were sufficient to keep the ewes in good breeding condition. Lots 2 and 4, Shropshire ewes and Delaine-Merino, respectively, were fed a roughage ration composed of corn silage and alfalfa hay, together with a grain ration as in lots 1 and 3.

During the first four weeks all lots made good gains. The second period of four weeks gave good gains to lots 2 and 4, but only 0.366 lb. per head in lot 1 and a loss of 0.5 lb. per head in lot 3. All lots lost weight during the third four week period. Comparing lots 1 and 2, the average weight during the winter was greatest in lot 2. The same correlation in average weight existed in lots 3 and 4. These results are the reverse of those secured during the first winter's investigation (E. S. R., 34, p. 171). During the winter period the average loss per ewe in lot 1 was 20.044 lbs. and 5.209 lbs. in lot 2. The Delaine-Merino ewe gained in weight during the winter, lot 3 gaining 1,933 lbs. per head, and lot 4, 17,431 lbs.

The average amount of air-dry matter consumed per head by the Shropshire ewes maintained on corn silage as a sole roughage was 1,922 lbs., while lot 2 averaged 2,651 lbs., lot 3, 1,655 lbs., and lot 4, 2,336 lbs. Comparing the Shropshires in lot 1 with the Delaine-Merino in lot 3, the latter consumed 0.257 lb. less per head and 0.197 lb. more per 100 lbs. live weight during the winter. The Delaine-Merino ewes in lot 4 consumed 0.335 lb. of air-dry matter more per 100 lbs. live weight and 0.315 lb. less per head than the Shropshire ewes of lot 2. The daily cost of maintaining the breeding ewe was 1.522 cts. in lot 1, 2.248 cts. in lot 2, 1.317 cts. in lot 3, and 1.851 cts. in lot 4. The amount of wool produced was slightly greater in lots 1 and 3 than in lots 2 and 4. No effect of the ration fed could be detected from the market classification.

The Shropshire ewes in lot 1 that yearned averaged 3.5 lbs. less in weight than those of lot 2. Their lambs averaged 0.9 lb. more per head than those of lot 2, but the mortality of both ewes and lambs was greater in lot 1, indicating that the ration possessing corn silage as a sole roughage for Shropshire ewes did not prove satisfactory in this experiment. The pregnant Delaine-Merino ewes in lot 3 averaged in weight 9.6 lbs. less than the ewes of lot 4

that yearned. The lambs also averaged less in weight at birth in lot 3 than in lot 4, were less active, and had a greater mortality.

A comparison of the Shropshires with the Delaine-Merinos showed their respective average weight to have been 150.5 and 102.9 lbs. At birth the Shropshire lambs average 7.93 lbs. per head and the Delaine-Merino lambs 6.89 lbs. The Shropshire ram lambs averaged 8.27 lbs. and the ewe lambs, 7.28 lbs., while the Delaine-Merino ram lambs averaged 7.1 lbs. and the ewe lambs, 6.64 lbs.

The Shropshire ewes averaged 141.6 lbs. per head at the end of four weeks, after yearning, a loss of 10.9 lbs. per head. The Delaine-Merino ewes averaged 104 lbs. per head, an average loss of 1.4 lbs. per head during this period. The Shropshire lambs averaged 21.5 lbs. at the end of four weeks, an average gain of 13 lbs. per head, while the Delaine-Merino lambs averaged 20.4 lbs. per head, an average gain of 12.9 lbs. per head. Comparing lots 1 and 3 with lots 2 and 4, respectively, practically the same gains in live weight of lambs were made.

In summarizing, it is concluded that the two winter periods show that a ration composed of corn silage as a sole roughage supplemented with cotton-seed meal for every 25 lbs. of corn silage fed is unsatisfactory for pregnant ewes, even when supplemented by a good grain mixture. Lambs dropped by ewes of the mutton and wool types, fed a ration composed of corn silage supplemented by cotton-seed meal, as compared with ewes of the same types fed a roughage ration composed of corn silage and alfalfa hay, are heavier, weaker, less active at birth, and have a greater mortality. Breeding ewes fed a ration composed of corn silage supplemented by cotton-seed meal were less active and showed lower vitality during the latter stages of pregnancy than ewes fed corn silage and alfalfa hay as roughages. Lambs raised by breeding ewes of both breeds fed corn silage as a sole roughage and cotton-seed meal as a supplement made satisfactory gains and matured into good vigorous lambs. Corn silage and alfalfa hay proved to be a satisfactory roughage when supplemented by a grain mixture composed of shelled corn, oats, wheat bran, and linseed meal, 5:3:2:1, for maintaining pregnant ewes in vigorous condition for yearning. The cost of feeds consumed by lot 1 during the winter of 1911-12 was \$3.19 per ewe, and in 1912-13, \$2.38; for lot 2 during the winter of 1911-12 \$4.11 per ewe, and in 1912-13, \$3.46; for lot 3 during the winter of 1911-12, \$2.74, and in 1912-13, \$2.03; and for lot 4 during the winter of 1911-12, \$2.78, and in 1912-13, \$2.85. The value of fleeces per head was \$1.767 in 1912 and \$1.968 in 1913 for lot 1; \$1.591 in 1912 and \$2.025 in 1913 for lot 2; \$3.02 in 1912 and \$2.882 in 1913 for lot 3; and \$2.731 in 1912 and \$2.795 in 1913 for lot 4.

The cost of maintaining Shropshire breeding ewes was greater than the cost of maintaining Delaine-Merino ewes, and slightly greater on a live-weight basis. Delaine-Merino lambs made less rapid gains than Shropshire lambs. Delaine-Merino ewes were observed to be more easily afflicted by "foul foot," due to damp weather, than Shropshire ewes. Wintering pregnant ewes in an open shed was conducive to the health and thrift of the ewes and lambs. Such quarters, however, should have a southern exposure, a dry bed, and a well-drained and spacious yard.

Hog and sheep pasturing demonstrations. R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 27, 28*).—Thirteen head of 73.5-lb. pigs were put on a 3-acre tract of clover in the spring. Without supplementary feed, 0.57 lb. per hog per day was made for 31 days. During the succeeding 30 days they were also fed rolled barley at the rate of 0.5 lb. per hog per day, and an aver-

age daily gain of 0.44 lb. per hog was made. During the 56 succeeding days the animals were run on the same clover, and in addition pastured off 4 acres of field peas grown in an adjoining tract. On this ration they made an average daily gain of 0.77 lb. per hog.

It is estimated that for the entire period \$11.35 per acre was realized from the clover, and \$6.80 per acre from the peas for a 52-day period. In addition to these pigs 20 head of small pigs were also run on both the clover and pea pasture.

For the purpose of determining the amount of gain that sheep will make and with what degree of success they can be kept in bearing orchards, 8 ewes with their lambs were kept on 1 acre of clover that had reached an average height of 10 in. for three weeks and fed it down closely. The following two weeks they fed down an additional acre, the decrease in time necessary being principally due to the greater amount of forage consumed by the lambs. During 52 days the lambs gained 63.2 lbs. each, and the ewes 3 lbs. each, making a total gain of 534 lbs. for the 16 head. From the amount of forage consumed by these animals it appears that 10 head of sheep, half of which are mature, can be carried on 3 acres of clover in bearing orchards.

Dry lot versus pasture crops for growing and fattening pigs for market. W. H. TOMHAVE and H. H. HAVNER (*Pennsylvania Sta. Rpt. 1914, pp. 122-128, pls. 5*).—Four 1-acre plats were sown for a rotation of pasture crops consisting of oats and Canadian field peas; field corn drilled; and rape. A lot of 19 9-week-old pigs was pastured on these plats and a similar lot pastured on a dry lot of $\frac{1}{2}$ acre. The pigs on the dry lot were fed a ration of corn meal and tankage 8:1, and those on pasture corn meal and tankage 12:1.

The pigs on forage-crop pasture made larger and more economical gains than those in the dry lot. The cost of grain per pound of gain varied from 4.72 to 5.96 cts. in the pasture lot, and from 6.08 to 7.6 cts. in the dry lot. The rate of gain varied from 0.804 to 1.57 lbs. per pig daily in the pasture lot, and from 0.724 to 1.378 lbs. in the dry lot, due to the two systems of management. The pigs on pasture had a higher degree of finish and were more thrifty than those in the dry lot. The use of a rotation of pasture crops proved more profitable than dry-lot feeding.

[Feeding experiments with hogs], W. H. TOMHAVE (*Pennsylvania Sta. Rpt. 1914, p. 82*).—In an experiment to determine the value of pasture for growing pigs as compared to dry-lot feeding two lots of weanling pigs were fed as follows: Lot 1, a grain ration of corn meal and tankage, 12:1, in addition to pasture; lot 2, corn meal and tankage, 8:1. The pigs on the pasture made greater daily gains at smaller expense than did those in the dry lot, and they also showed greater thrift.

In a second experiment one lot of 10 shotes was fattened in a dry lot and fed ear corn and 0.25 lb. of tankage. Another lot was given access to standing field corn, and in addition received 0.25 lb. of tankage per head daily. The pigs made an average daily gain of 1.45 and 1.74 lbs. per head, respectively, gaining 11.6 and 12.3 lbs. per bushel of corn consumed, and returning \$0.2 and \$0.5 cts. per bushel of corn consumed.

Fattening pigs for market. W. H. TOMHAVE and H. H. HAVNER (*Pennsylvania Sta. Rpt. 1914, pp. 117-121, pls. 5*).—Four lots of three 138-lb. pigs each were fed for 84 days as follows: Lot 1, corn meal and tankage, 10:1; lot 2, shelled corn and tankage, 10:1; lot 3, buttermilk and corn meal, 1:1, and lot 4, wheat middlings and corn meal, 1:1. These lots made average daily gains of 1.723, 1.567, 1.82, and 1.146 lbs. per head, consuming 3.746, 4.025, 3.267, and 4.7 lbs. of concentrates per pound of gain, costing 1.559, 1.415, 1.5, and 1.424 cts. per

pound of feed consumed, and realizing a total profit per lot of \$14.15, \$13.44, \$15.50, and \$6.04 for the respective lots.

Feeding and management of hogs, J. I. THOMPSON (*California Sta. Circ. 151* (1916), pp. 16, fig. 1).—This circular treats of the breeding, feeding, care, and management of hogs under California conditions, and of the butchering, curing, and keeping of pork.

Hens confined as compared with hens having access to open yard, M. C. KILPATRICK and D. E. WARNER (*Pennsylvania Sta. Rpt. 1914, pp. 121, 122*).—In an experiment to determine the relation between the number of eggs laid, the amount of feed consumed, and the physical condition of each flock, two lots of 40 White Leghorn hens each were fed, lot 1 being confined and lot 2 having the use of a yard.

At the end of the first 13 weeks the fowls in pen 2 had laid 466 eggs, whereas those in pen 1 had laid only 179. During the second 13 weeks pen 2 laid 1,285 eggs and pen 1, 1,221. During the third 13 weeks pen 2 laid 2,079 eggs and pen 1, 1,589. During the last 13 weeks pen 2 laid 1,525 eggs and pen 1, 1,483.

It is concluded that in order to obtain the best results in egg production it is a decided advantage to allow the flock of hens the use of a yard where they may have room to exercise and secure green feed at certain seasons of the year. There seemed to be, however, a period, from about January to April, when the egg yield from both pens ran about parallel, and when the egg yield from the pen of fowls which had the use of the yard did not indicate that it is necessary for the hens to be out of doors during the winter months.

There was apparently little difference in the amount of feed (concentrates) consumed by each pen, but the results show that the lot which laid the largest number of eggs consumed a little more feed than the other lot. The hens in pen 2 consumed more feed in the first and third periods, and the fowls of both pens ate the most feed at the time when their egg production was the highest. There was no great difference in the physical condition of the fowls of the two lots. In the lot confined, however, the hens seemed to have more completely molted at the end of the first year's work than the lot which had the use of the run.

Ostrich investigations, R. H. WILLIAMS and W. S. CUNNINGHAM (*Arizona Sta. Rpt. 1915, pp. 560-562*).—A distinct difference was noted in the general appearance of eggs laid by hens of different breeds. Observations during the past year indicated no appreciable difference in the number of eggs laid by the South African and Nubian hens, the average number of eggs laid by the South African hens being 20, the Nubian hens 20.5, and the crossbreeds 23.33. More variation was noted between hens of the same breed than the average of different breeds.

It is possible that the South African hens laid smaller eggs than those of the Nubian breeds, but the crossbred hens laid the largest eggs, averaging 1.616.36 gm. The variation, however, between the average weight of eggs laid by the different hens was great. Thus it is noted that the South African hens laid eggs that weighed from 1.270.6 to 5.110.7 gm., and eggs from the four hens of this breed averaged 1.444.03 gm. The crossbred hens laid eggs that averaged 172.6 gm. heavier than the South African and 27.7 gm. heavier than the Nubian hens.

Similar conclusions may be made with regard to the effect of breed upon the width and length of the eggs. The South African hens laid eggs that were rather short in length and round in appearance, while the crossbred and Nubian hens laid eggs that were larger, of about the same diameter, but greater in length. There seems to be a striking correlation throughout between the weight,

length, and width of eggs, and breed characteristics seem to be significant, although not definitely proved.

It has been shown that ostriches are similar to poultry in that hens beginning to lay early in the season are usually the best layers. The four hens that began to lay in January averaged 36 eggs during the season, and produced 72 per cent of the eggs laid during the year, while only 28 per cent came from the other five hens. The average number of eggs laid by hens beginning to lay in February was 21, in March, 11, and in April, 8.

DAIRY FARMING—DAIRYING.

Influence of environment and breeding in increasing dairy production. H. H. KILDEE and A. C. McCANDLEISH (*Iowa Sta. Bul. 165 (1916), pp. 383-402, figs. 29*).—In this investigation it was attempted to determine the influence of pure-bred dairy sires in increasing the production from a foundation of scrub cows as well as the effect of improved feeding and management. In order that other influencing factors might be brought to a minimum, scrub cows from an isolated region of Arkansas were selected for the basis of this work in 1907. The work is still in progress and the data presented in this publication are in the form of a preliminary report, taking all records completed up to the end of 1915.

The animals purchased were inferior individuals, being rather small, of very limited abdominal, udder, and vein capacity, and very unprepossessing so far as quality and top lines were concerned. The scrub cows and their calves were given the same care, feed, and shelter as the pure-bred dairy cattle in the herd. This environment has remained fairly constant during the eight years' work. Pure-bred sires of the Guernsey, Holstein, and Jersey breeds were used on these scrub cows and all heifer calves grown under the same conditions as the pure-bred calves on the farm. Heifers by pure-bred sires were bred to other pure-bred sires of the same breed and the heifer calves resulting from this union were also kept for dairy purposes.

The results of the eight years' work as given are summarized as follows: The scrub cows that came to the station when young (four years old) increased in production rapidly and steadily up to the fourth lactation period after reaching the station, when they produced 59 per cent more milk and 54 per cent more fat than during the first period. The scrub cows that came to the station advanced in age did not increase in production after the first year. However, it can not be said that their production was not greater than it had been under their original environment.

The scrub heifers developed at the station averaged 13 per cent more milk and 12 per cent more fat than did the scrub cows that came to the station when four years old or over. The daughters of all except one pure-bred bull have proved to be much better producers, as 2- and 3-year-olds, than their dams as mature cows. The average of all the records made by first generation heifers by a pure-bred Holstein sire show an increase of 2,314.5 lbs., or 71 per cent, in milk and 67.15 lbs., or 42 per cent, in fat, at an average age of three and a half years, over the records of their scrub dams at an average age of six years. The average record of the one first generation Jersey grade that has freshened was 205.0 lbs., or 6 per cent, more milk and 32.0 lbs., or 20 per cent, more fat, at an average age of two and a half years, than the record of her scrub dam at an average age of seven years.

The greatest increase shown by any of the first generation grades was by the second Guernsey bull used. This heifer as a 2-year-old produced 3,451 lbs., or 131 per cent, more milk and 179.22 lbs., or 136 per cent, more fat than the

average record of her scrub dam reared at the station. However, the average records at an average age of three years made by the first generation grades by the first Guernsey sire used were not quite equal to those of their mature dams, and variation in the ability of sires to transmit dairy qualities is deemed a factor to be considered in selecting a pure-bred bull to head a scrub or common herd, as well as for a high grade or pure-bred herd.

In persistency of milk production the grades were intermediate between the scrub and the pure-bred cows in the herd. The first generation grades were much superior to their dams in dairy conformation. Many of the first generation grades showed the characteristic color of their sire's breed; however, in the case of the Holsteins this was not so pronounced until the second generation. There was no appreciable difference between the scrub and grade calves so far as coefficient of digestion is concerned, but the grades had a greater capacity for handling concentrates than had the scrubs.

Silage alone, compared with silage and hay, as roughage for dairy cows, H. P. DAVIS (*Pennsylvania Sta. Rpt. 1914, pp. 173-182*).—Two lots of five cows each were fed for three periods of four weeks each. Lot 1 received silage alone for roughage during periods 1 and 3 and mixed hay and silage during period 2, and lot 2 received hay and silage during periods 1 and 3 and silage alone during period 2.

The milk yield decreased with both systems of roughage, but the decrease was less with silage and hay. When silage and hay for roughage followed silage alone there was a slight increase in milk yield over the initial production. Except in one instance there was a decrease each period. When the cows received hay they consumed practically the same amount of silage as when no hay was included in the ration. Both lots consumed an excess of protein and net energy above that necessary for maintenance and milk production when based on Eckles' standard. There were no apparent undesirable physical effects from the feeding of silage alone for roughage with the grains used. There was very little difference in the cost of the two rations or in the feed cost of milk and milk fat. No perceptible difference was observed in the health of the two lots.

The effect of open-shed housing as compared with the closed stable for milch cows, H. P. DAVIS (*Pennsylvania Sta. Rpt. 1914, pp. 183-226, pls. 3*).—Continuing work previously reported (E. S. R. 34, p. 182) the results of three years' studies on the effect of open-shed housing and closed stable are given. Two lots of cows were treated alike in every respect except that of housing, lot 1 being kept outside and lot 2 inside.

From the data presented it appears that cows kept under an open shed have keener appetites and consume somewhat more roughage than those kept in stables. There was sufficient protein consumed, when either Armsby's, Van Norman's, or Eckles' standard was considered, to meet the requirements for milk and to maintain the animals. Figured on Eckles' standard there was a slight excess of energy consumed above maintenance and milk production the first two years, and a small deficiency the last year. When computed on Armsby's and Van Norman's standards there was a deficiency in energy consumed for maintenance and milk production each year, except for lot 1 the second year.

The milk yield of the outside lot for the three years was 35,723.8 lbs. and for the inside lot 35,322.3 lbs. It decreased more rapidly each winter for the outside than for the inside lot. Sudden drops in atmospheric temperature caused decreases in milk yield for both lots, the outside lot having a slightly greater decrease. More bedding was required outside, but less labor was necessary to keep the animals clean. Both lots finished each winter's trial in good health,

with the exception of one cow which reacted to the tuberculin test in April, 1914. She had shown no reaction in two previous tests. The hair of the animals kept outside was longer and coarser the first two winters. The third winter this was noticeable in only one animal.

Studies on the market milk of Iowa, B. W. HAMMER and A. J. HACHEL (*Iowa Sta. Bul. 164 (1916), pp. 311-380*).—In these studies samples of milk, cream, both table and whipping, and buttermilk were examined. The milk and cream samples were scored according to the score cards adopted by the U. S. Department of Agriculture, while the whipping cream was scored according to the cream score card, with the exception that 30 per cent fat was considered perfect and one point was deducted for each half per cent below this. The buttermilk was examined for flavor, fat, and acidity only. The samples were collected in twelve cities of the State of various sizes.

It was found that some of the market milk and cream of Iowa contains excessive numbers of bacteria. In some cities the average bacterial content of the pasteurized product exceeds that of the raw, although most frequently that of the raw is the greater. Some of the milk and cream sold is very poor in flavor, while some is very satisfactory. Only a small percentage of the samples examined were low in the amount of fat or solids-not-fat. Large amounts of sediment are not uncommon, while some samples show only insignificant amounts of sediment. Excessive amounts of acid are sometimes found in both milk and cream. From the results of the investigation it is concluded that the presence of colon bacteria is a rather unsatisfactory basis for judging the sanitary quality of a sample of milk or cream.

A considerable amount of bulk milk is still sold in Iowa. Quart and pint bottles of milk and half-pint bottles of cream commonly showed considerable variations in the amounts of material contained. It is deemed reasonable when buying quarts to expect an amount not over 2 per cent low, when buying pints to expect an amount not over 3 per cent low, and when buying half pints to expect an amount not over 4 per cent low.

A proposed score card for bacteria in pasteurized milk is given.

A study of the manufacture of dairy butter, E. L. ANTHONY (*Pennsylvania Sta. Rpt. 1914, pp. 163-173, pls. 8*).—An experiment was conducted to determine the variations between the different styles of common farm churns as to the percentage of moisture and salt left in the finished butter, as well as the length of time of churning, the percentage of fat left in the buttermilk, and the average rise of temperature of the buttermilk during churning. The types of churn used were a 15-gal. barrel churn, 12-gal. swing churn, and a combined churn and worker. The average moisture content of the butter from the respective churns was 12.39, 13.5, and 13.6 per cent; the average salt content, 4, 3.8, and 2.45 per cent; the time required for churning, 40, 47, and 29 minutes; the rise of the temperature in churning, 6.3, 7, and 5° F.; and the average fat content of the buttermilk, 0.19, 0.229, and 0.18 per cent.

The results of further studies indicate that by properly regulating the churning factors the percentage of moisture can be materially raised without affecting the uniformity. In order to secure a high moisture content it is found better to stop churning while the butter is still in small granules. The studies also showed that with the common hand worker moisture is generally lost as the working progresses, while by working the butter in the combined churn the moisture content increases after a certain amount of working.

Overripened cream did not produce butter of so good quality as cream that was less ripe. In view of those studies it is recommended that cream be ripened to not more than 0.5 per cent acid, and that as low as from 0.3 to 0.4 per cent is advisable under average farm conditions. Three methods (a)

holding cream below 45° until enough had been secured for churning, then raising the temperature to 75° and ripening overnight or till 0.5 per cent of acid had developed, (b) ripening the first gathering at 75° until 0.35 per cent of acid had developed, then cooling to 55°, adding subsequent gatherings, and churning without further ripening, and (c) adding a quart of good buttermilk to the first gathering adding each day's gathering, holding at cellar temperature until enough had been secured for churning, and ripening if necessary by warming to 75° until 0.5 per cent of acid had developed, were all commonly used, viz, that of holding cream at cellar temperature without trying to control the bacteria which produce the flavors in cream. With average farm cream handled under proper conditions a uniform butter of good quality and score could be produced. The method of holding cream at 75° until 0.3 per cent acid is developed and then churning it made butter with better keeping qualities. Butter not worked enough was gritty and mottled, but too much working destroyed the grain and resulted in a greasy product.

[Dairy investigations] (*Wisconsin Sta. Bul. 268 (1916), pp. 34-36*).—Tentative results of a study of Wisconsin butter marketing conditions conducted by B. H. Hibbard and A. Hobson in cooperation with the Office of Markets and Rural Organization of the U. S. Department of Agriculture indicate that the quality of butter as it is now handled does not result in a material difference in price. The uniformity in product adherent to the package and the advertising given to the product appear to be factors of no small moment in the determination of price.

In experiments by J. L. Sammis an effort has been made to extend the use of the method of pasteurizing milk for cheese-making purposes by the use of the "holding" instead of the "flash" method of heating. The tentative results secured indicate that a product of good quality can be made, and also point to the possible elimination of the method of acidulating the milk for the restoration of its coagulating power with rennet, as has been found necessary by the use of the "flash" method of heating. The process has proved a success in commercial practice.

Experiments have been made with reference to the application of the method to the manufacture of brick cheese. An improvement in the flavor of the product was secured, the gas-producing bacteria were eliminated, and an increase in yield was obtained.

Making butter and cheese on the farm. C. LARSEN and V. R. JONES (*South Dakota Sta. Bul. 164 (1916), pp. 344-374, figs. 18*).—This bulletin gives detailed methods for making butter and cheese on the farm. Among the kinds of cheese discussed are Cheddar, cottage, Neufchâtel, pimento, cream, olive cream, and club cheese.

VETERINARY MEDICINE.

Infection and immunity. C. E. SIMON (*Philadelphia: Lea & Febiger, 1915, 3, ed., rec. and enl., pp. X+17-551, pls. 12, figs. 21*).—In this new edition of the work previously noted (*E. S. R., 30, p. 578*), the recent advances in the study of Abderhalden's protective ferments and the associated technique have received detailed consideration. The section on the Wassermann reaction has been almost entirely rewritten. The manner in which danger from anaphylactic shock during serum treatment may be reduced to a minimum has also received attention. Emphasis has been given to the important observation of Schick and his collaborators that it is possible to recognize those individuals whose blood normally contains a quantity of diphtheria antitoxin sufficient for protective purposes by the aid of an allergic skin reaction.

A bibliography is appended to each chapter and, although not considered complete, represents those papers on which the volume as a whole is based.

International catalogue of scientific literature. R—Bacteriology. QR—Serum physiology (*Internat. Cat. Sci. Lit.*, 11 (1915), pp. VIII+583+148+27).—The eleventh annual issue of this catalogue (E. S. R., 32, p. 578), which contains schedules and indexes in four languages and an author and a subject catalogue. The subjects catalogued include general and special bacteriology, parasitic protozoology, and serum physiology.

Histological researches on the behavior of the blood platelets in anaphylaxis. U. PARDI (*Arch. Ital. Biol.*, 64 (1915), No. 1, pp. 89-96, pls. 2).—From the studies reported the author concludes that the anaphylactic poison provokes the rapid formation of a thrombus of the platelets in the lungs and liver. There is a close relation between this condition and the morbid phenomena. Such a condition in the pulmonary vessels clearly explains the respiratory symptoms and pulmonary emphysema noted in anaphylactic shock.

The relative value of certain methods for the production of antisheepamboceptor. ROSE SCHWETZER and V. STEVENS (*Collected Studies Bur. Lab. Dept. Health N. Y. City*, 8 (1914-15), pp. 433-435).—After investigating a number of procedures the following is deemed the most preferable, since it results in the lowest percentage of mortality and in the most potent immune serum: Inoculation of 50 per cent suspension in a series of increasing doses, beginning with 0.25 cc. and increasing 0.25 cc. every third day.

The proteins and antitoxin in the serum of goats immunized against diphtheria. E. J. BANZHAF and L. W. FAMULENER (*Collected Studies Bur. Lab. Dept. Health N. Y. City*, 8 (1914-15), pp. 208-212).—The unit relationship per gram of protein of the pseudoglobulin and euglobulin remained practically the same during the course of immunization.

The diphtheroid bacillus of Preisz-Nocard from equine, bovine, and ovine abscesses.—Ulcerative lymphangitis and caseous lymphadenitis. I. C. HALL and R. V. STONE (*Jour. Infect. Diseases*, 18 (1916), No. 2, pp. 195-208).—The authors report having isolated the Preisz-Nocard bacillus from characteristic abscesses in eleven horses and one calf.

"The etiology of the lesions from which it was obtained is identical with that of caseous lymphadenitis of sheep, and the disease in horses known as ulcerative lymphangitis should be differentiated by laboratory diagnosis from farcy, epizootic lymphangitis, and sporotrichosis, all of which have a mutual resemblance clinically. Bacillus Preisz-Nocard is a diphtheroid bacillus, presenting interesting characteristics as follows: (1) The production of orchitis in guinea pigs, as well as suppurative processes generally throughout the lymphatics; (2) the hemolysis of blood agar plates not containing an excess of fermentable carbohydrate; and (3) the elaboration of a soluble toxin, resembling but not identical with that of diphtheria, yet being neutralized partly by diphtheria antitoxin. This apparent partial neutralization suggests the existence of group reactions among soluble bacterial toxins, analogous to the group reaction of precipitins and agglutinins.

"We again draw attention to the uncertainty of experimental orchitis in guinea pigs as a certain test for glanders, and emphasize the necessity of microscopic and cultural examination of pus from such lesions for diagnostic purposes."

Vaccinoprophylaxis and vaccinotherapeutics of glandular diseases by means of a new antistreptococcus vaccine with sensitized virus. M. CARPANO (*Mod. Zoovet., Parte Sci.*, 26 (1915), No. 9, pp. 353-379; *abs. in Internat. Inst. Agr. [Rome]*, *Mo. Bul. Agr. Intel. and Plant Diseases*, 6 (1915), No. 12, pp. 1662-1663).—In order to eliminate the susceptibility of treated animals to diseases

due to streptococci during the negative phase after treatment with a "polyvalent antistreptococcus serum" and vaccines now in use, the author has prepared a new polyvalent antistreptococcus vaccine with sensitized virus. The vaccine is obtained from several strains of sensitized streptococci, which are subsequently allowed to sterilize themselves or are killed at low temperatures. The method of preparation is described in detail.

Experimental results submitted show that horses stand small and moderate doses very well which cause no perceptible general reaction when injected subcutaneously. The local reactions are restricted to an edema which afterward hardens and is reabsorbed without forming an abscess. A general effect which may last several days and is undoubtedly due to the absorption and action of the endotoxins produced by the streptococci is manifested after the injection of large doses (50 cc.). For horses of average size the most suitable dose was found to be 25 cc. An active immunity sets in immediately after the injection and is very complete and lasting.

The vaccine also appears to possess undoubted therapeutic properties. This action, though limited, indirectly insures that the vaccine when used for prophylactic purposes will not produce any negative phase. It can therefore be used to advantage in cases of adenitis as well as in suspected infections.

Nitric acid compared with tincture of iodine in the cauterization of wounds infected with rabies virus, D. W. POOR (*Collected Studies Bur. Lab. Dept. Health N. Y. City*, 8 (1914-15), pp. 111, 112).—Results obtained from experiments on three series of eight guinea pigs each show that 75 per cent of the control animals died after an average incubation of 14½ days. Of the animals cauterized with nitric acid only 37.5 per cent died, indicating a saving of 37.5 per cent by means of the acid. Two of the pigs in this group which died of rabies showed an average incubation of 22.5 days, a lapse of time that would permit of a course of Pasteur treatment with a subsequent interval of two weeks for the full development of immunity. Pigs which had their wounds treated with tincture of iodine showed a mortality of 100 per cent. Seven of the animals had an average incubation of 18½ days, and one an incubation period of 29 days.

The practical significance of these results is indicated.

Further studies of biological methods for the diagnosis of tuberculosis, J. BROSFENBRENNER, M. H. KAHN, J. ROCKMAN, and M. KAHN (*Arch. Int. Med.*, 17 (1916), No. 4, pp. 492-508).—From a further study of the value of biological methods of diagnosis of tuberculosis the authors conclude that "different samples of tuberculin of Besredka, though apparently identical in the mode of their preparation, may differ among themselves in their specific values."

"The most striking variation is in the amount of lipins contained in tuberculin. It is necessary to free each sample of tuberculin of all its lipin fraction before using such tuberculin for the complement deviation test. The lipins may be extracted by fat solvents, but the easiest method was found to be that of separation of the protein fraction by precipitation. Precipitation of the antigenic fraction of tuberculin also offers the possibility of using a standard number of units of antigen and thus eliminating variations due to the quantitative differences in specific properties of different samples of tuberculin, without increasing the chance of obtaining lipotropic reactions."

"It seems, however, that different samples of tuberculin may vary also qualitatively. The variation rests apparently on the fact of the existence of strain specificity in the antibody. The existence of strain specificity in tuberculosis may explain why the results obtained by different investigators in the complement-deviation test for diagnosis of tuberculosis vary so much."

"The tuberculin of Besredka seems to give the best results in diagnosis by the complement-deviation test. Even though the test is positive in a certain number of clinically nontuberculous cases, the reaction seems to be specific. In at least 87 per cent of such cases the fixation was obtained also with one or more preparations of tuberculins other than that of Besredka."

A bibliography of 47 references to the literature cited is included. See also a previous note by Craig (E. S. R., 35, p. 180).

Report on tuberculin tests, L. CORRETT and A. S. GRIFFITH (Roy. Com. Tuberculosis, Final Rpt., II, App., Sup. Vol., 1913, pp. 148, figs. 101).—This supplemental volume reports the results of tuberculin tests on the ox, pig, goat, horse, rhesus monkey, chimpanzee, baboon, mangabey monkey, lemur, dog, cat, rabbit, and fowl. The effect of the successive injections of tuberculin into tuberculous animals, the action of homologous and heterologous tuberculin, the effects of tuberculin when given by channels other than that usually employed, the more immediate effects of injecting living tubercle bacilli into tuberculous animals when compared with those produced by tuberculin, and the ophthalmic tuberculin test were also studied and the results reported.

The experimental results are reported in tabular form, and the febrile conditions of the animals after inoculation are presented graphically. See also a previous note (E. S. R., 35, p. 75).

The characteristics of tubercle bacilli in human bone and joint tuberculosis, A. EASTWOOD and F. GRIFFITH (Jour. Hyg. [Cambridge], 15 (1916), No. 2, pp. 257-329).—The results of an investigation of 261 cases are summarized in the following table:

Types of tubercle bacilli at different age periods.

Age period.	Number of cases.	Human.	Bovine.	Atypical.
<i>Years.</i>				
0-5.....	47	21	14	2
5-10.....	108	75	31	2
10-15.....	62	52	7	3
15-20.....	15	12	2	1
Over 25.....	29	21	7	1

The percentage of bovine cases for all ages from this series is thus 21.7; for cases under ten years, 20; and for cases over ten years, 9.4.

Clinical data and bacteriological results of the cases are reported in detailed tabular form, together with the results and post-mortem findings of inoculation experiments on rabbits with viruses of "human" and "bovine" types of bacilli obtained from the organisms isolated from some of the cases.

The types of tubercle bacilli occurring in tuberculosis of the human genitourinary tract, A. EASTWOOD and F. GRIFFITH (Jour. Hyg. [Cambridge], 15 (1916), No. 2, pp. 310-314).—In an examination of 17 cases the "human" type of bacillus was obtained in 14 instances and the "bovine" in 3. The 3 "bovine" cases were affections of the kidney in persons aged, respectively, 25, 19, and 20 years.

The clinical data and bacteriological results of the cases examined are reported in detailed tabular form.

Avian tuberculosis, C. H. HIGGINS and A. B. WICKWARE (Canada Dept. Agr. Health Anim. Branch Bul. 18 (1915), pp. 10, pl. 1, figs. 3).—This bulletin briefly discusses the prevalence, symptoms, and course of the disease; post-mortem findings; transmission of tuberculosis from birds to man; and prevention and treatment.

The authors have observed and demonstrated the presence of the disease in two canaries. Gross lesions were present in nearly every organ and microscopic examination showed great numbers of acid-fast bacilli of the avian type. The disease has also been observed in turkeys in a number of instances.

Investigations to determine the possibility of congenital tuberculosis being present in chicks have been carried on by the authors, but the experiments in this connection have thus far yielded only negative results. The results however, are not considered conclusive.

In an examination of eggs bacilli microscopically indistinguishable from those of tuberculosis were found in about 20 per cent of the eggs examined. Subsequent inoculation of guinea pigs with material from these eggs produced a generalized tuberculous infection from which typical avian cultures were procured.

In experiments with tuberculin as a practical method of diagnosis no marked variation in temperature was observed in four fowls which received 2 cc. of avian tuberculin subcutaneously. In four fowls which were given 1 cc. of concentrated tuberculin intradermally (the thickened skin of the breast) no evidence of any local or thermal reaction was observed. Fowls which received one drop of tuberculin in the eye manifested no evidence of an ophthalmic or a thermal reaction.

Further studies on the nutritive deficiencies of wheat and grain mixtures and the pathological conditions produced in swine by their use, E. B. HYER, W. S. MULLER, and E. V. MCCOLLUM (*Jour. Biol. Chem.*, 25 (1916), No. 2, pp. 239-259, pls. 5, figs. 9).—The animal (swine) feeding experiments herein reported supply information regarding the rôle played in both animal and human nutrition by toxic materials in apparently normal food products, the results reported being supplementary to those obtained by the authors in earlier work (*E. S. R.*, 35, p. 472). Their conclusions are in part as follows:

"Malnutrition, histologically characterized by nerve degeneration, may result from the absence of certain factors in the diet, as in the case of beri-beri. A similar condition may likewise arise from the presence of toxic materials in apparently normal food products and in the presence of all known factors essential for continued growth and well-being.

"With a large mass of wheat in the ration of swine toxicity will follow, even in the presence of all the recognized factors for growth. Only in the presence of very liberal quantities of all these factors can the effect of the toxicity be overcome. This toxicity manifests its action by producing important histological changes in the nervous system of the animal, not unlike those recorded for beri-beri. No one important factor for growth, such as better proteins, salts, or fat-soluble A, appears able to act as a complete corrective for this toxicity.

"It also appears possible to produce similar pathological conditions in swine in the absence of all known toxic material and in the presence of a fair quality of protein, a plentiful supply of fat-soluble A and water-soluble B, but a poor salt mixture, namely, that natural to the grains used."

Studies on the transmission and prevention of cestode infection in chickens, J. B. GUTHERLET (*Jour. Amer. Vet. Med. Assoc.*, 49 (1916), No. 2, pp. 218-237).—"The results of these experiments show that the intermediate (cysticercoid) stage of *Choanotania infundibuliformis* occurs in the common house fly (*Musca domestica*). The results were obtained by feeding flies on eggs of the tapeworm and raising cysticercoids in a fly; also by feeding chicks on flies and raising the worms in the birds. By morphological comparison of the cysticercoid and an adult they are shown to be identical. Results from experi-

ments by feeding flies on eggs from *Darainaea cesticillus* and *D. tetragona* were negative.

"The habits of the birds are important factors to be considered in experimental work for life-history studies. Certain insects are found in great numbers around chicken houses and yards and are readily eaten by the birds. Flies are known to contain the larval stage of one species of cestode, and some other species of insects are to be considered as probable intermediate hosts for other species of cestodes.

"The symptoms and effects of the infection from tapeworms vary with individual birds, age of birds, and the degree of infection. Birds infested with worms display an emaciated, unthrifty condition, an unnatural desire for food and water, and a marked diarrhea, with droppings of a characteristic yellowish-brown color.

"The control of tapeworm disease in chickens is in an unsettled condition. Little can be done until more is known concerning life histories of worms. Preventive measures are urged rather than curative measures. Droppings should be cared for and treated with appropriate substances in order to prevent insects from feeding on them or developing in them. Experiments by giving lye with food to infested chickens showed satisfactory results in removing tapeworms.

"The flocks of chickens that were studied showed at times a very heavy infection, and nearly every bird examined harbored one or more species of worms. Five species were found in the chickens at Hardy, Nebr., and three in the birds at the poultry farm at the University of Illinois. The species found in Nebraska are *D. cesticillus*, *D. tetragona*, *D. echinobothrida*, *Hymenolepis carioca*, and *C. infundibuliformis*. At the poultry farm of the university the species *D. cesticillus*, *D. echinobothrida*, and *H. carioca* were found."

RURAL ENGINEERING.

Annual report of the agricultural engineer during 1914-15, W. M. SCHUTTE (*Ann. Rpt. Dept. Agr. Bombay, 1914-15, pp. 72-87*).—This is a report of the activities of the agricultural engineer's office, which included experiments on implements and machinery, power, irrigation, water supply, and mechanical cultivation.

Methods of stream gaging, W. S. PARKER (*Engin. News, 75 (1916), No. 19, p. 889*).—This is a mathematical analysis of computation methods generally used.

Surface water supply of the Great Basin, 1913 (*U. S. Geol. Survey, Water-Supply Paper 360 (1916), pp. 293, pls. 2, fig. 1*).—This report, prepared in cooperation with the States of Utah, Nevada, California, Oregon, and Idaho, presents the results of measurements of flow made during 1913 on streams in the Great Salt Lake and Sevier Lake basins, minor basins in Nevada, Humboldt-Carson sink basin, Pyramid and Winnemucca lakes basins, Surprise Valley, and Honey, Warner, Abert, Silver, Malheur, and Harney lakes basins.

Surface water supply of St. Lawrence River basin, 1914. W. G. HORT, A. H. HORTON, C. C. COVERT, and C. H. PIERCE (*U. S. Geol. Survey, Water-Supply Paper 384 (1916), pp. 128+XXIX, pls. 2*).—This report, prepared under the direction of N. C. Grover and in cooperation with the States of Minnesota, Wisconsin, New York, and Vermont, contains the results of measurements of flow made in 1914 on streams tributary to Lakes Superior, Michigan, Huron, Erie, and Ontario and to the St. Lawrence River.

Surface water supply of the Lower Mississippi River basin, 1914. N. C. GROVER, R. FOLLANBEE, and G. A. GRAY (*U. S. Geol. Survey, Water-Supply*

Paper, 387 (1916), pp. 60+XXXIV, pls. 2).—This report, prepared in cooperation with the States of Colorado and New Mexico, presents the results of measurements of flow made on streams in the Arkansas and Red River basins during 1914.

Surface water supply of New Mexico, 1914, J. A. FRENCH (Santa Fe, N. Mex.: State Engin. Dept., 1914, pp. 151, pls. 4).—This report, prepared in cooperation with the U. S. Geological Survey, presents the results of measurements of flow made on streams in the principal river basins of New Mexico in 1914.

Geology and underground water of Luna County, New Mexico, N. H. DARTON (U. S. Geol. Survey Bul. 618 (1916), pp. 188, pls. 13, figs. 15).—This is a more complete and detailed report of work previously noted (E. S. R., 32, p. 284).

Geology and ground waters of northeastern Arkansas, L. W. STEPHENSON and A. F. CHIDEN (U. S. Geol. Survey, Water-Supply Paper 399 (1916), pp. 315, pls. 11, figs. 4).—This report describes the physiography and geology of northeastern Arkansas and discusses the occurrence and distribution of surface and ground water by counties. A section, by R. B. Dole, on the chemical character of the surface and ground waters of the region is also included.

Colorado River and its utilization, E. C. LA RUE (U. S. Geol. Survey, Water-Supply Paper 395 (1916), pls. 25, figs. 5).—This paper gives the results of measurements of flow made on the Colorado River and its tributaries and deals with the utilization of the water for irrigation and power development purposes.

Physical properties of some toxic solutions, G. B. RICE, H. L. TRUMBULL, and MATTIE LINCOLN (Bot. Gaz., 61 (1916), No. 5, pp. 408-416).—Experiments on the osmotic pressure and surface tension of (1) water obtained from sphagnum bogs of the Puget Sound region and Alaska, and (2) solutions obtained by allowing rhizomes of *Nymphaea polycarpa* to decay in water are reported.

It was found that "the osmotic pressure of bog water in the samples tested was higher during the rainy season than at the close of the dry season. The osmotic pressure of the waters tested from lakes and springs was lower during the rainy season than at the close of the dry season. There is no indication that either high osmotic pressure or low surface tension is an important factor in the toxicity of bog water or of very dilute solutions resulting from the decay of *Nymphaea* rhizomes."

Tests of a new process of sewage purification with grease recovery and apparent profit, R. S. WESTON (Amer. Jour. Pub. Health, 6 (1916), No. 4, pp. 344-345, fig. 1; abs. in Engin. News, 75 (1916), No. 19, p. 913).—Experiments with Boston sewage conducted by E. S. Dorr and by the Massachusetts Institute of Technology are reported and compared. The process involves the addition of either sulphuric or sulphurous acid to the sewage to precipitate the bulk of the solids in the form of a sludge which can be dried and degreased, the purpose being to produce a greaseless fertilizer and to save the grease.

From the experiments by Dorr it was concluded that each 1,000,000 gal. of sewage would yield 1,361 lbs. of fertilizer base, "which was estimated according to agricultural standards to be worth \$13.59 a ton.

The Massachusetts Institute of Technology experiments verified the results with reference to the amount of sludge obtained from Boston sewage. The results obtained were taken to indicate "that the sludge from the Miles process, although less in bulk than that from the activated sludge process, has a value of more than \$24 per million gallons of sewage."

Irrigation investigations, G. E. P. SMITH and A. L. ENGER (*Arizona Sta. Rpt. 1915*, pp. 570-577, figs. 2).—The work in irrigation investigations at the station for the year is reviewed. Data on the economics of pump irrigation indicate that "in general, the most advisable practice consists in wells of 600 to 2,000 gal. capacity, pumps of the sizes from 4 to 8 in., 4-cycle oil engines of from 12 to 60 horsepower, and enough farmers cooperating—two, three, or four—to utilize fully the plant 140 hours each week through the good growing months from April to August."

Tests of a 15-in., 5-stage, 110-ft. pump with the bottom of the bowls 28.5 ft. below normal water level are also reported. "The tests show that a very high efficiency can be obtained with this type of pump if the pump is working under its best conditions of head and discharge, but that at other heads or other discharges the efficiency may be low. This emphasizes the importance of knowing the operating conditions in advance and of buying a pump especially designed for those conditions."

The irrigation of sugar cane in Mauritius, F. A. STOCKDALE (*Dept. Agr. Mauritius, Gen. Ser., Bul. 6 (1916)*, [English Ed.], pp. 12, pl. 1, fig. 1).—This pamphlet deals with the scientific principles and the essentials of practice of irrigation with special reference to the irrigation of sugar cane on the island.

The operations of the Royal Commission of Irrigation in the first triennium, O. BORDIGA (*Atti R. Ist. Incoragg. Napoli, 6. ser., 66 (1915)*, pp. 1-16).—The first three years' activities of the commission are reported, which deal briefly with defects in the irrigation laws of Italy; irrigability of lands; irrigation economics; and irrigation water, its quality and action on crops and soil.

Annual irrigation revenue report of the Government of Bengal for the year 1914-15 (*Ann. Irrig. Rev. Rpt. Bengal, 1914-15*, pp. 114-71, pl. 1).—This report covers the year 1914-15.

Report of the state drainage commission of Minnesota (*Rpt. State Drain. Com. Minn., 1915*, pp. 63, pls. 11).—This reports the activities of the state drainage commission of Minnesota and the work and expenditures of the state drainage engineer's office. The text of the laws prescribing the duties and defining the powers of the state drainage commission is also given, together with engineering information regarding drainage areas in Minnesota, evaporation, precipitation, run-off waters and formulas, state ditches, and maxbucca, minimum, and average discharge of various streams of the State.

Tests show strength of corrugated culvert pipe, G. L. FOWLER (*Engin. Rec., 73 (1916)*, No. 21, pp. 668, 669, figs. 4; *abs. in Engin. News, 75 (1916)*, No. 20, p. 953).—Tests under hydrostatic pressure of 12-, 24-, and 48-in. corrugated iron pipes with corrugation depths of $\frac{1}{4}$ and $\frac{1}{2}$ in. and uniform pitch of corrugations of $2\frac{1}{2}$ in., and sand bed tests of the same, are reported. Considering the three variables, diameter of pipe, thickness of metal, and depth of corrugation, the following formula was developed:

$$P = \frac{5,960 CT}{2 \left(\frac{D-12}{12} \right)^2} \left(1 - 0.1 \log \frac{D}{12} \right)$$

where P =collapsing pressure in pounds per square inch, C =corrugation depth in inches, T =thickness of metal in inches, and D =inside diameter in inches.

For sizes from 10 to 24 in., metal thicknesses of from 0.0625 to 0.14 in., and working pressure of half the collapsing strength, the formula was simplified to

$$\text{working pressure} = \frac{31,000 CT}{D} \quad \text{on the assumption that for this range of sizes the}$$

collapsing pressure varies inversely as the diameter.

In the sand bed tests it was found that there was arching of the sand under pressure. "It was found that the lateral thrust rose to a maximum under a shallow depth and remained practically constant. With a slightly yielding bottom the sand arched to relieve the bottom of load which was carried by frictional resistance of sand against the box sides. In the main tests, it was found that when the platen was wider than the pipe the pressure was largely supported by the column of sand over the pipe and less by the more yielding sand beyond the pipe walls. Then the load imposed on the pipe was greater than as if considered uniformly distributed by the platen. The results exhibited the conveyance and distribution of sand pressures, but were not considered sufficient to warrant developing a formula for calculating culvert pressures. For instance, it was seen that the top pressure on pipe decreases with a given load placed on increasing depths of sand, but the proportional relations were not disclosed. The lateral pressures were low and no definite ratio was established. The lateral pressure increased rapidly from the top down to a point determined by the angle of repose of the sand and then decreased. . . .

"It is concluded that under the heaviest load that can now be applied to railway ties by any existing locomotive or car, a 21-in. 14-gage pipe with 3-in. depth of corrugation, and under 24-in. cover of dry sand, can not be deflected beyond its elastic properties of complete shape recovery. The 36- and 48-in. culverts are held to be uncrushable under a cover equal to their own diameter. The weight of cover in a wide loose fill or bank is not so well supported as in a ditch, and it was concluded that conditions of unusual severity might be induced which should be provided for by heavier metal."

Experiments on the distribution of vertical pressure in earth. R. B. FENNA (*Ann. Rpt. Penn. State Col. 1914, pp. 117-123, pls. 13*).—The results of tests with dry sand, silty yellow clay, gravelly silt loam, and brown dry river sand, and on a mixture of these, to determine the distribution of pressure due to a concentrated load through various depths of the soils are graphically reported, together with a description of methods and apparatus used.

"The following depths of sand were tested: 3, 6, 12, 18, 24, 36, 48, and 59 in. For each depth the eccentricity of the load was varied from 0 to 42 in. both right and left. The loads were applied in increments of 1,000 lbs. as indicated by the gage up to the point where the loading strip sank into the sand as fast as the load was applied. As determined from the calibration curve these loads varied from about 600 lbs. to between 2,200 and 6,000 lbs., according to the depth of the sand."

It was found that "there was a very marked change in the percentage of transmission when the eccentricity of the load was equal to the width of the weighing strip and at this point the maximum value was 13 per cent. For greater eccentricities this value was never exceeded. . . . The size of the restricting box does not make any appreciable difference in the results. The maximum bearing power of the sand decreased with the depth of sand. . . . There was a distinct tendency for the percentage of transmission to increase as greater loads were applied."

With the clay loam sand mixture "the method of procedure was exactly the same as in the sand tests except that the eccentricity of the load was varied from 24 in. right to 24 in. left, and back across the soil to the starting point. . . . The depths tested were as follows: 6, 9, 12, 18, 24, and 36 in. . . .

"In practically all cases there was quite a regular increase in the percentages of transmission as the load varied from 600 to 10,000 lbs. per square foot, the maximum loads causing an average increase of 36 per cent in the transmission as produced by the minimum loads. . . . The tests in loam were run in exactly

the same way as those on the clay mixture, but only on 6, 12, 24, and 36-in. depths. . . . As in the case of clay there was quite a regular increase in the percentage of transmission as the loads varied from 500 to 10,000 lbs. per square foot, the average increase from minimum to maximum being 47 per cent."

It is generally concluded that "the percentage of transmission increases with increase of load. For depths of earth greater than 2 ft. the percentage of transmission is always less than 20. For eccentric loads the percentage of transmission is always less than 20 when the loading strip is not over any part of the weighing strip."

Pressure of wet concrete on the sides of column forms, A. B. McDANIEL and N. B. GARVER (*Engin. News*, 75 (1916), No. 20, pp. 933-936, figs. 5).—Field and laboratory tests made at the University of Illinois are reported.

The laboratory tests were made on 12- and 20-in. square column forms 12 ft. high made of planks, with ship lap joints. The concrete was a 1:2:4 mixture of standard cement, glacial sand, and crushed limestone. The following conclusions were drawn: "The lateral pressure increases with the head up to a certain point, after which the pressure remains nearly constant until the pouring ceases. It is probable that, during the early part of the pouring, the concrete is supported by pressure upon the base of the form, and later a considerable part of the concrete is supported by arch-like action on the sides of the form. In this respect the action of green concrete seems to be similar to that of grain, seeds, clean dry sand, etc., in a bin. The lateral pressure in general corresponds to hydrostatic pressure for wet concrete. The lateral pressure increases with the rate of pouring and the degree of wetness and of the consistency. The lateral pressure is about the same for column forms up to 20 in. square."

The field tests were conducted on a reinforced concrete arch highway bridge. "The tests were made on the spandrel posts of the longer spans. These posts have a cross section of 23 by 30 in. and a maximum height of about 15 ft. They have both vertical and horizontal reinforcing bars." The concrete was a 1:2:4 mixture of cement, sand, and gravel. It was found "that the pressure gradually increases with the head until a maximum is reached, after which the pressure falls off. The height at which this maximum pressure occurs depends upon the consistency of the concrete and upon the rate of pouring. The actual pressures recorded approximate very closely that of a liquid having the same weight as the concrete, or about 145 lbs. per square foot per foot of head."

"The results obtained from the field tests agree closely with those secured from the laboratory tests. Concrete falling against the forms may result in high lateral pressures due to impact. A value of 145 lbs. per square foot [per foot] of height would be a rational value for lateral pressure to use in the design of forms. The results of these tests are not conclusive, but it is believed that they are sufficiently consistent and accurate to furnish lateral-pressure values which may be used as a basis for the design of forms under average working conditions."

Dynamite experiments, B. BUNTING (*Agr. Bul. Fed. Malay States*, 3 (1915), No. 3, pp. 337-341; *also in U. S. Dept. Com., Com. Rpts.*, No. 102 (1916), p. 416).—Experiments to test the effect of explosives on the growth of rubber in loam soil overlying a heavy clay are reported.

"Taking the experiments over a period of one year it [was] observed that whereas the control gave an increase of 21.93 in., the dynamite plot gave an increase of 32.14 in. for every 100 in. of the original girth, or an increase over the control of 10.2 per cent. . . .

"Dynamite is unequalled for breaking up hardpan or layers of impervious subsoil, which not only prevent the roots from going down to the subsoil but interfere with the drainage. It is most effective on heavy clay and hard laterite soils and least effective on light or loose soils which offer no resistance to the explosion. It might be profitably employed in holling previous to planting, especially in heavy soils, half a charge of dynamite being sufficient for this purpose. It may be successfully used in breaking up logs and tree stumps infected with termites in rubber clearings. The value of dynamite for cultivation is not doubted, but the high cost of the explosive prevents its more general use."

Stump removal, G. LUNDBERG (*Skogsvårdsför. Tidskr.*, No. 5 (1915), Sup. 1, pp. 40, figs. 25).—This report deals with stump breaking and removal and describes and illustrates methods and machinery used in this work in Sweden.

The American road, I, II, J. I. TUCKER (*Norman, Okla.: Author, pts. 1, 1915, pp. 34+5; 2, 1916, pp. 35-62+14, figs. 5*).—Questions and texts prepared for the extension division of the University of Oklahoma are given.

Road laws of Ohio (*Columbus, Ohio: Bd. Library Comrs. Ohio, 1915, pp. XXXIX+335*).—The text of the laws is given in three parts.

Part 1 includes the Cass highway act, which is a codification and revision of the more important road laws that were in force previous to its enactment. Part 2 contains sections of the general code relating to the duties of various county and township officials in connection with roads and the provisions relative to tax levies and the limitation of the tax rate. In many instances citations are given to court decisions. Part 3 presents the law relating to motor vehicles.

Good roads year book, 1915 ([*Off. Good Roads Year Book U. S., 1916, 5. ed., pp. VII+440*]).—This is the fifth number of this book (E. S. R., 29, p. 388), containing information regarding road improvements under federal, state, territorial, and local control; historical notes and technical details of road construction and maintenance; and European road systems. Miscellaneous information regarding highway bonds, state geologists, and manufacturers of road machinery and equipment, engineering equipment, and road-building materials is included, together with a bibliography of 249 treatises on road, bridge, and culvert construction and allied subjects.

Proceedings of the Pan-American Road Congress, held at Oakland, California, September, 1915 (*Proc. Pan-Am. Road Cong., 1915, pp. XI+416, pl. 1*).—These proceedings contain the following special papers:

The History and Future of Highway Development, by L. W. Page; The Relation of the Road to Rail and Water Transportation, by C. J. Tilden; The Benefits and Burdens of Better Roads, by S. E. Bradt; Road Building in the National Forests, by H. S. Graves; The Essentials of Proper Laws for Highway Work, by E. A. Stevens; Federal Aid to Rural Districts, by C. L. MacKenzie; Proper Road Location, Its Importance and Effects, by W. R. Roy; Road Drainage and Foundations, by G. W. Cooley; Highway Bridges and Structures, by W. S. Gearhart; Highway Indebtedness. Its Limitation and Regulation, by N. P. Lewis; Organization and System in Highway Work, by A. B. Fletcher; The Educational Field for State Highway Departments, by L. S. Smith; Roadway Surfacing, by F. F. Rogers; Resurfacing of Old Roads, by W. D. Uhler; Street Pavements, by C. Hill; System in Highway Accounting, by S. D. Gilbert; Uniformity for Highway Statistics and Data, by H. E. Reed; Engineering Supervision for Highway Work, by P. Hubbard; The Determination of the Justifiable Outlay for Specific Cases of Highway Improvement, by C. Richardson; How to Take the Roads Out of Politics, by R. H. Dana; Con-

vict Labor for Highway Work, by G. P. Coleman; Motor Traffic, Its Development, Trend, and Effects, by A. W. Gould; Equipment for Highway Work, by A. H. Blanchard; Comparisons of Traffic and Their Economic Value, by I. White; Maintenance—Materials and Methods, by A. W. Dean; and Dust Suppression and Street Cleaning, by W. H. Connell.

Grading aggregates for Illinois concrete roads, A. H. HUNTER (*Concrete [Detroit, Mich.], 8 (1916), No. 5, p. 209*).—A table giving the present requirements as to gradation of aggregates for concrete road work in Illinois is given, together with a table of unit costs of several concrete roads built by day labor under the supervision of the Illinois Highway Commission.

Test of Douglas fir bridge stringers, H. B. MacFARLAND (*Bul. Amer. Ry. Engin. Assoc., 17 (1916), No. 184, pt. 2, pp. 281-467, figs. 153; abs. in Engin. and Contract., 45 (1916), No. 19, pp. 427-430, fig. 1; Engin. Rec., 73 (1916), No. 13, p. 479*).—Tests of 61 representative Douglas fir stringers in which the stringers were subjected to a process of creosoting involving boiling under vacuum are described. Nine of the specimens were put to special tests after treatment, while 52 stringers were cut in two and comparative tests made of the untreated and treated halves.

"A comparison of the results of the transverse tests, applying loads at the third points, of 7 by 16 in. by 14 ft. span treated and untreated stringers shows that of the 52 representative untreated specimens 16 failed by shear, 29 by tension, 3 by tension and shear, 2 by crushing and tension, 1 by crushing and shear, and 1 by crushing, while the following numbers of treated stringers failed from the causes noted: Thirty-two shear, 14 tension, 4 tension and shear, and 2 crushing and shear. . . . The average elastic limit of the untreated pieces was 4,269 lbs. per square inch as compared to 3,481 lbs. per square inch for the treated stringers. The average modulus of rupture was 5,691 lbs. per square inch for the untreated and 4,680 lbs. per square inch for the treated stringers. The average longitudinal shear for the untreated pieces was 411 lbs. per square inch, which was 78 lbs. per square inch greater than that for the treated specimen.

"Specimens for the compression tests, applying the load parallel to the grain, were 5 by 5 by 12 in. in size. It was found that the maximum load for the untreated pieces was 4,114 lbs. per square inch and 3,830 lbs. per square inch for the treated blocks. Applying the load perpendicular to the grain of 6 by 6 by 30 in. blocks showed that the treated specimens had an average elastic limit of 322 lbs. per square inch, which was 116 lbs. per square inch less than the average for those that were not treated. The average area penetrated by creosote as determined by this test was 20.41 per cent."

The following conclusions were drawn: "Moisture may be successfully removed by boiling under vacuum. Moisture determinations show that, on an average, 35 per cent of the total moisture was removed by the process. The removal of moisture by boiling under vacuum, preliminary to creosoting, decreases the physical strength of the material. The weight of creosote per unit of volume for treated material is dependent on the structure of the specimen. Spring wood offers greater resistance to treatment than summer wood. Special tests of treated stringers indicate that the decrease in physical strength due to treatment is not confined to the area penetrated by creosote. The entire structure is affected. The compressive strength parallel to the grain was decreased 6 per cent. The compressive strength perpendicular to the grain was decreased 26 per cent. Although the average strength of the treated material is appreciably decreased, its stiffness, as measured by the modulus of elasticity, is not affected. In general, the average strength of

Douglas fir bridge stringers, subjected to the boiling-under-vacuum process of creosoting, was five-sixths of its original strength."

Automobile registrations, licenses, and revenues in the United States, 1915 (*U. S. Dept. Agr., Office Sec., Circ. 59 (1916), pp. 15, fig. 1*).—This bulletin contains tabulated data on the following: Motor-vehicle registrations, licenses, and revenues, 1915; motor-car registrations and gross motor-vehicle revenues, 1913-1915; motor-vehicle registration and license fees in force January 1, 1916; and administrative provisions in force January 1, 1910, affecting motor-vehicle registrations, licenses, and revenues.

"During 1915 the total gross revenues derived from the registration of motor vehicles and the licensing of operators, chauffeurs, dealers, etc., amounted to \$18,245,718. . . . Of the total revenue collected during 1915 practically 90 per cent was applicable to road work, and of this slightly over 70 per cent was placed more or less directly under the control and supervision of the state highway departments. . . .

"The number of motor vehicles registered under the general designation of automobiles, motor trucks, and commercial vehicles in continental United States during 1915 amounted to a total of 2,445,664. The total road mileage of the United States outside of incorporated towns and cities is approximately 2,375,000 miles. There is, therefore, an average of slightly more than one motor car for each mile of rural public road in the United States."

Prevention of pounding in kerosene engines. J. A. MOYER and J. P. CALDERWOOD (*Ann. Rpt. Penn. State Col., 1914, pp. 169-177, pls. 10*).—Experiments with a 4-cycle hit-and-miss governed oil engine with a cylinder bore of 6.75 in., a 10-in. stroke, and a clearance of 22.9 per cent to determine the cause of pounding and methods for its prevention are reported. The carburetor was an experimental spraying type.

It was found that pounding was increased by increasing the temperature of the gas, increasing the temperature of the jacket water, and increasing the spark advance. Pounding was decreased by increasing the fuel rate and increasing the water injection. "In attempting to draw conclusions from these results it is practically impossible to state whether this pounding was produced by cracking of the heavier hydrocarbons or by high flame propagation, but from a practical point of view the conditions affecting either of these causes are identical, and inasmuch as we can prevent or govern this pounding by the use of water and rich fuel mixtures, meaning a relatively large amount of kerosene used compared with the air, it seems that differentiation as to ultimate cause is not necessary. . . . In using gasoline under conditions of fuel mixture and water temperature similar to those imposed upon kerosene in these tests the pounding and the indicator cards are identical with those of kerosene. These tests show also very clearly that the temperature of the fuel mixture at the firing period is the condition that governs the quality of the pounding."

Directory and specifications of leading makes of trailers (*Farm Machinery, No. 1284 (1916), pp. 18, 19*).—This list contains the names and specifications of 75 types of trallors or 30 different makes.

Official tests of mechanical cultivation. RINGELMANN (*Jour. Agr. Prot., n. ser., 29 (1916), No. 4, pp. 74, 75*).—The more important results of tests of several outfits are summarized in the following table.

Results of mechanical plowing tests.

Type of outfit.	Depth of plowing.	Width of plowing.	Average speed per hour.	Area plowed per hour.	Fuel consumption.	
					Per hour.	Per hectare.
	Centi-meters.	Meters.	Meters.	Square meters.	Kilo-grams.	Kilo-grams.
Motor cultivator.....	3.5	1.00	4,572	3,165	3.55	11.2
Motor plow.....	14.4	.56	4,032	1,346	5.98	44.4
Tractor.....	15.0	2,952	1,306	5.42	41.3
Do.....	16.0	.96	2,880	2,043	7.73	57.8
Do.....	24.0	.59	2,916	1,214	5.83	48.0
Do.....	15.5	.57	2,952	1,054	10.42	98.8
Do.....	18.1	.59	4,560	1,510	8.70	56.1
Do.....	13.2	1.50	1,728	1,830	4.43	34.2
Do.....	12.3	.99	3,132	2,116	6.12	48.8
Do.....	16.1	.99	3,024	2,052	9.40	73.9
Do.....	18.0	1.25	2,700	2,280	10.01	78.4
Do.....	14.2	1.19	2,880	2,134	6.89	53.9
Do.....	15.4	1.17	2,844	2,110	6.74	51.9
Do.....	16.5	1.20	3,060	2,371	7.04	55.7

Power required for grinding Pennsylvania and Argentine cereals in flour mills, D. W. DEBUICK (*Ann. Rpt. Penn. State Col. 1914, pp. 123-133, pls. 16*).—Tests to determine the relative amount of power required for grinding winter and spring wheat, the effect on power requirements for the mill occasioned by the conditioning of wheat by the application of moisture to the wheat hull, and the power required for grinding corn and other grains are reported.

It was found "that the winter wheat, conditions being equal, takes considerably less power than spring wheat, and again tempered or conditioned wheat less power than dry. Also that the mills with longer or more roll surface take less power than with shorter or less roll surface, as a comparison of the four tests on spring wheat shows that the five-break, ten-reduction mill takes the least and the three-break, five-reduction mill, the most power. The dry wheat takes more power than the conditioned wheat to which had been added 3 per cent of water and lying six hours to mellow. . . .

"It was found that when the brushes or scrapers were adjusted, as is usual against the rolls to scrape off material adhering to them in crushing, the rolls took on an average 27 per cent more power than when running with the scraper off. However, in grinding with full load this relation would be changed to about 8 per cent of the power to the rolls. . . .

"It required a little over 38 per cent more power to grind the same quantity of Argentine corn in the same time to the same degree of fineness than for the Dent variety. The second grinding took on an average 68 per cent more power than the first grinding. Power for grinding ordinary white corn is practically the same as that for Yellow Dent. . . .

"The graphic chart shows that there were differences in cleaning wheat, also that the corn took less power for cleaning than wheat. . . . The winter wheat took 50 per cent of the power to the scourer, the spring wheat dampened 47.73 per cent, and the spring wheat dry 45.24 per cent, while the corn took 40.3 per cent. . . .

"In the large class of mills the proportion of roll surface and other machinery per barrel is generally considerably less than that for a small mill, and is owing to a more minute division of and consequently a more equitable distribution of stock throughout the mill. A 25, 50, or 75 barrel mill will use 1.8 to 2 in. per barrel or even more, whereas a 500 or 1,000 barrel mill will use 1.7 to 1.6 in. or even less per barrel and consequently somewhat less.

power per barrel. The following formula may be used for determining capacity and power:

$$C = \frac{d n S l}{f b} ; h = \frac{1}{c} \text{ and } T = C p \text{ where}$$

C =capacity in barrels; d =diameter of roll, inches; n =3.1416; S =speed of fast roll, revolutions per minute; l =total length of roll surface, inches; f =constant used=100; b =barrel=196 lbs.; h =inches roll per barrel; p =horsepower per barrel, as 0.4 for plain, 0.35 for collar, and 0.26 for ball bearing; T =total horsepower for mill."

Composition of galvanized-wire fencing materials, E. S. EBB and W. FREAR (*Pennsylvania Sta. Rpt. 1914, pp. 377-390, pls. 3*).—This article reports studies of the composition of more or less well-known wire fencing materials and of newly purchased portions of the principal commercial brands on sale in Pennsylvania, together with a description of methods of analysis.

Farm buildings, how to build them, W. E. FRUDEN (*Charles City, Iowa: Author, 1916, pp. 63, figs. 159*).—This is a booklet of practical information intended for the farmer and rural contractor, covering the construction of general farm barns, hog houses, cribs and granaries, poultry houses, fences, homes, miscellaneous farm buildings, and handy devices.

Community hog houses, J. B. DAVIDSON, J. M. EYVARD, and W. G. KAISER (*Iowa Sta. Bul. 166 (1916), pp. 406-458, figs. 43*).—This bulletin enumerates the essential features of an ideal hog house and the advantages and disadvantages of the community type of hog house, and describes and illustrates the construction of two successful types of community hog houses, namely, the "Iowa sunlit community hog house" and the "semi-monitor roof house".

The distinguishing features of the Iowa sunlit community hog house are the location of the windows in the roof, thus furnishing direct sunlight to all parts of the house, and low walls used with the idea of reducing cost of construction.

The distinguishing feature of the half-monitor roof hog house is the arrangement and location of the windows. "A row of vertical windows is provided for lighting each of the two rows of pens. The house extends with the long axis east and west, and is not at all adapted to any other direction. When the windows are placed at the right height, direct sunlight will shine into both rows of pens at the same time. If plenty of windows are provided, the pens will be quite thoroughly lighted."

A previous bulletin by Eyvard and Davidson dealt with movable hog houses (*E. S. R., 32, p. 284*).

Water supply for the country home, M. K. SNYDER (*Wash. State Col., Dept. Ext. Bul. 11 (1916), pp. 62, figs. 27*).—This bulletin deals with the sanitary aspects of farm water supplies, purification of farm water supplies, and small water supply systems.

With reference to source, farm water supplies are divided into rain, surface, spring, and ground waters. The usual precautionary statements regarding the protection of wells and springs are given. With reference to the safe distance from pollution for wells it is stated that "If the earth is reasonably uniform, without any well-defined channels along which the water passes, the safety distance is from 75 to 100 ft. above the source of pollution to from 200 to 250 ft. below the source. If there are well-defined channels in the earth, no distance below the source of pollution is safe."

Water purification by mechanical and chemical treatment is discussed and the doubtful utility of small faucet filters pointed out. With reference to small sand filters, it is stated that "the sand layer, at the time of construction, should not be less than about 3 ft. deep and depths greater than 5 ft. are costly

without giving added safety. The water should be kept at a depth of 2 ft. or more over the top of the sand so that the surface of the sand will not be disturbed by any possible currents from the entering water or from other sources. . . . The best results are obtained by using for the filter sand a sand that will pass through a screen having about 20 meshes to the inch, and will not pass a screen having 50 meshes to the inch. . . . The rate of operation should be about 50 gals. per square foot per day." Chemical treatment by use of calcium hypochlorite and quicklime is also described.

The discussion of water supply systems includes descriptions of centrifugal, plunger, and air-lift pumps and hydraulic rams. It is concluded that "if pumping is done by hand from a well of any considerable depth, the cylinder must be of small diameter and the discharge will be correspondingly small. Even when a windmill is used in direct connection with a pump, it is best to use a cylinder of small diameter so that the mill will pump with light winds (8 to 12 miles per hour). But when a gasoline engine or an electric motor is used the power is supplied at a constant rate and the pump should be selected to use this power. This allows the selection of a pump with larger cylinder and consequently less time is required to do the pumping."

Cost data are also included.

House heating, J. L. Mowry (*Univ. Minn., Dept. Agr., Ext. Bul. 60 (1916), pp. 15, figs. 21*).—This pamphlet deals with the general proposition of house heating and describes the stove, hot-air, hot-water, and combination hot-water and hot-air systems, giving hints on installation and automatic control.

RURAL ECONOMICS.

Rural economy in New England at the beginning of the nineteenth century, P. W. BOWELL (*Trans. Conn. Acad. Arts and Sci., 29 (1916), pp. 243-329*).—The author has classified the changes in the rural economy in New England into three periods as follows:

"(1) The period of self-sufficient economy, which had existed since the settlement of the country, reaching the highest point of its development at the beginning of the nineteenth century, a period in which the characteristic features of rural economy were the absence of any market for farm produce and the consequent dependence of each town and, to a large extent, of each household, even, on its own resources for the satisfaction of its wants; (2) the period of transition to commercial agriculture, under the stimulus accorded by the rise of manufacturing enterprises in inland towns and villages and the consequent demand for food and raw materials on the part of the newly arisen nonagricultural population, the years included in this period being approximately the two generations from 1810 down to the close of the Civil War; and (3) the period of decadence of New England agriculture, extending from the close of the Civil War to the end of the nineteenth century, a period in which the increasing pressure of Western competition caused the abandonment of large numbers of New England farms and a decline in both the quantity and quality of the rural population."

The author presents a survey of the rural economic conditions in Massachusetts, Connecticut, and Rhode Island at the close of the first period under the following chapter headings: The inland towns and their village settlements, the coast and river towns, commercial relations of southern New England with the Southern States and the West Indies, internal trade and the transportation system, the agricultural industry, and home and community life in the inland town. A brief bibliography is appended.

A rural survey of Morgan County, Missouri, W. L. NELSON and M. W. WITTEN (*Missouri Bd. Agr. Mo. Bul.*, 14 (1916), No. 2, pp. 51, figs. 35).—This bulletin summarizes replies received from public-school teachers and children, relative to farming conditions within the county, the condition of the rural schools, farmhouses, and the types of farming and of other rural industries.

[Farming and farm labor conditions in North Carolina] (*Ann. Rpt. Dept. Labor and Print. N. C.*, 29 (1915), pp. 16-29).—These pages give by counties the condition of the land, tendencies regarding the size of farms and diversifications, wages paid, the cost of producing the principal farm crops, and the condition of the roads, education, and finances.

List of farms for sale, 1915 (*Hartford, Conn.: Bd. Agr.*, 1915, pp. 157, figs. 17).—This bulletin brings up to date for 1915 the list previously noted (*E. S. R.*, 32, p. 390) of farms for sale in Connecticut.

Farms for sale or rent in New York, 1916, C. W. LARMON (*N. Y. Dept. Agr. Bul.* 78 (1916), pp. 425-624, pls. 44).—This bulletin brings up to date for 1916 the list previously noted (*E. S. R.*, 33, p. 490).

Pennsylvania farms for sale (*Penn. Dept. Agr. Bul.* 273 (1916), pp. 106, pl. 1).—This bulletin contains a compilation of the farms in Pennsylvania offered for sale, and gives a detailed description of the land, buildings, water supply, and distances from the railroad station, post office, and churches, together with the price asked.

Statistics and agriculture, R. KINDLER (*Mitt. Deut. Landw. Gesell.*, 31 (1916), No. 4, pp. 46-54).—In this article are discussed the various types of statistical reports relating to agriculture, methods of reporting, and the general tendency of agricultural production in Germany as revealed by her agricultural statistics.

The rural life of Japan (*Tokyo, Japan: Bur. Local Affairs*, 1914, pp. 111+54, pls. 8).—This book contains a number of typical instances illustrating the industrial and moral spirit of the farming classes and the influence of the authorities and leaders in building up an ideal type of rural people.

Farm contracts between landlord and tenant, W. C. TICHENOR (*Lebanon, Ohio: Author*, 1916, pp. XII+245).—This book outlines the different types of contracts that are in common practice between landlord and tenant, and the subjects of agreement arising in farm leases and the law pertaining to them. Copies of a number of lease contracts are included.

Amortization methods for farm mortgage loans, L. E. TRUESDELL and C. W. THOMPSON (*U. S. Dept. Agr., Office Sec. Circ.* 69 (1916), pp. 12).—This circular describes different methods of computing payments of mortgages by the amortization plan. Detailed tables are given showing the amount of payment necessary with the variation in interest and length of time for repayment by the various methods described.

Farm credit problems in Wisconsin (*Wisconsin Sta. Bul.* 265 (1916), pp. 32-34, fig. 1).—These pages contain a brief statement concerning the farm credit investigations of B. H. HILBARD, the results of which are given in detail in a bulletin previously noted (*E. S. R.*, 32, p. 892).

Annual report on the working of cooperative societies in the Bombay Presidency, 1915 (*Ann. Rpt. Work. Coop. Soc. Bombay Pres.*, 1914-15, pp. 34-71+5).—This report continues data previously noted (*E. S. R.*, 32, p. 593.)

Economic effect of cold storage upon the average price of eggs. B. GROENBECK and F. G. URNER (*New York: Joint Com. Cold Storage Warehousemen and Affiliated Indus.* [1916], pp. 10, pl. 1).—The authors have summarized their conclusions as follows:

"The per capita consumption of eggs at New York has increased largely since ample cold storage facilities became available.

"Considering differences in the quality of the eggs quoted there has been no considerable advance in wholesale values of fresh-gathered eggs, either during the season of flush or of short production, in the period 1900-1910 as compared with a similar period before cold storage was available.

"The average prices of fresh gathered and storage eggs taken together were lower during the season of scarcity in the period since cold storage has been available than were the prices for fresh-gathered eggs before cold storage was available, notwithstanding a well-known advance in the prices of nearly all commodities during the decade, beginning 1900.

"Accumulations of eggs in cold storage during the season of excess production are practically exhausted before the next season of flush begins.

"The ability to carry eggs in cold storage from the period of greatest production throughout the later period of shortage greatly increases the opportunity for profitable production without enhancing the average prices and adds to the food supply."

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 6, pp. 49-60, fig. 1*).—This number contains the usual data regarding the range of prices at important markets, average price paid to producer, and estimated farm values on May 15; together with data concerning the acreage in watermelons and cantaloups in 1915 and 1916 and the percentage of the crop harvested in each month, the condition on June 1 of the truck crops and the principal agricultural crops, and the estimated annual supply of potatoes in the United States.

A special report on long-staple cottons is included, indicating that 7.4 per cent of the total crop is of long-staple variety, which in an ordinary season amounts to approximately \$25,000 bales. According to this report, of the cotton produced in the principal cotton-producing States, the following percentages of the total are long-staple varieties: Arizona, 90; Mississippi, 22; Missouri, 20; California, 20; Arkansas, 14.4; and Oklahoma, 13.5. There is also included a special article by O. F. Cook on The New Long-Staple Cottons.

A recent statement issued by the U. S. Bureau of the Census regarding the manufacture of wagons and carriages is cited which indicates that the number of carriages manufactured in 1914 was 34 per cent less than in 1906 and the number of wagons 9 per cent less.

A special inquiry regarding the months in which hogs are slaughtered on farms shows that 32.1 per cent are slaughtered in December, 20.3 per cent in January, and 19.5 per cent in November; that is, practically 72 per cent of the hogs slaughtered on farms are slaughtered during these three months.

Acreage and live stock returns of England and Wales (*Id. Agr. and Fisheries [London], Agr. Statist., 50 (1915), No. 1, pp. 75*).—This report continues data previously noted (*E. S. R.*, 33, p. 789).

[Agricultural statistics of Hungary] (*Ungar. Statist. Jahrb., n. ser., 21 (1915), pp. 73-119*).—These pages continue data previously noted (*E. S. R.*, 34, p. 506).

[Agricultural statistics in Switzerland] (*Statist. Jahrb. Schweiz, 23 (1914), pp. 54-65*).—These pages continue data previously noted (*E. S. R.*, 33, p. 193).

Agricultural statistics of British India (*Statist. Abs. Brit. India, 49 (1904-5-1915-16), pp. 126-135*).—This report continues data previously noted (*E. S. R.*, 33, p. 295).

Statistical returns of crops in Southern Rhodesia, 1914-15, E. A. Nobes and B. Haslewood (*Rhodesia Agr. Jour., 13 (1916), No. 1, pp. 28-44*).—These pages contain a general description of the condition of agriculture in Southern Rhodesia, together with statistical data showing the area under crops, the total yields, the amount of silage, and the area of irrigated lands, with sources of water supply.

AGRICULTURAL EDUCATION.

Report of committee on graduate work in horticulture, M. J. DORSEY (*Proc. Soc. Hort. Sci.*, 12 (1915), pp. 74-87).—This survey of the present status of graduate work in horticulture is divided into three main heads, viz, (1) the teaching and research staff, (2) the material equipment, such as laboratory, library, orchard, etc., and (3) the product, or type of training given.

The staff is discussed from the standpoint of training, freedom of time, and specialization. A table comparing the formal degrees of the horticultural workers of 1915 with those of 1905 shows that there is a noticeable increase in the group of associates in the 10-year period, a relatively large decrease in the number of horticultural workers holding no degree, and in 1915 a relatively larger number of workers with only a bachelor's degree. Another table, comparing the formal degrees of the horticultural staff in 16 of the larger institutions giving graduate work in horticulture with those of the staff in the department of chemistry, calls attention to the larger number of workers in the chemistry group of the rank of instructor and assistant holding advanced degrees, and the larger number of heads of departments with the doctorate degree, suggesting the probable influence of this advanced training upon the standards of undergraduate as well as graduate instruction and departmental leadership. The committee considers specialization as one of the most effective means of increasing efficiency in the staff as well as giving a larger freedom of time. The exchange arrangement between Cornell and Wisconsin universities and the cooperative arrangement between the horticultural department of the West Virginia University and the department of plant physiology of the University of Chicago are mentioned as among significant recent movements toward giving instructors a broader experience and viewpoint.

The investigation of the product, or type of training given, reveals the facts that there are 9 institutions offering work in horticulture leading to the doctor's degree and approximately 20 scheduling work for the master's degree. The time required is uniformly one year's residence or the equivalent for the master's degree. The departments of horticulture offering work for the doctor's degree come under the control, in every case, of well-organized graduate schools, and the standardization of requirements for advanced degrees is well taken care of by other agencies, the uniform requirements for this degree being three years' residence in advanced work, as a minimum while research in one minor in some related field is generally required. At the present time there are registered 10 students for the doctor's degree in horticulture and 77 for the master's degree, exclusive of those at the Pennsylvania, Virginia, Massachusetts, or New Jersey colleges. Graduate courses in pomology are scheduled in 13 institutions, in olericulture in 9, in landscape gardening in 5, in floriculture in 6, and in plant breeding in 8, while 5 list their graduate work under thesis research. In the last five years there have been 84 theses in horticulture submitted, 19 states only being represented. An analysis of the subjects, practically all of which are for the master's degree, shows that 51 could be classified under pomology, 10 under plant breeding, 4 under olericulture, and 1 under landscape gardening. Nearly all of the institutions offering graduate work have assistantships or fellowships, varying in amounts from \$100 to \$1,000 a year, available in the department of horticulture. Extracts from letters are included setting forth the principles involved in residence credit for graduate assistants.

Report of committee on floriculture, E. A. WHITE (*Proc. Soc. Hort. Sci.*, 12 (1915), pp. 111-113).—The committee reports as to (1) the provision of better facilities for teaching floriculture, including new ranges at the Ohio and Indiana universities and the Iowa College, and extensive additions to

glass-house areas for teaching at the Illinois and Cornell universities, (2) the strengthening of courses and the marked improvement in the nature of the work given, and (3) the publication by the chairman of the committee of a text entitled *Principles of Floriculture* to meet the needs of smaller institutions where only a general course in floriculture is given in connection with other horticultural courses.

In institutions where there are special courses in floriculture the committee considers the lecture system, supplemented by required outside reading, the best method of instruction. It emphasizes the importance of requiring students intending to specialize first to have a knowledge of chemistry, soils, and fertilizers, and also botany in all its phases, especially in plant physiology and pathology. It considers business training an essential and a certain amount of farm practice as leading to greater efficiency, and is of the opinion that practical experience in floriculture can be secured nowhere better than in an up-to-date commercial range under the supervision of a broad-minded practical floriculturist.

Organization and methods for pomology extension work. R. W. REES (*Proc. Soc. Hort. Sci.*, 12 (1915), pp. 63-68).—The author outlines the development of pomology extension work and methods that have proved successful at the Massachusetts College. He believes that the "principle of close relationship and mutual understanding between the extension service, the experiment station, and the college is necessary for successful development. All extension work should be outlined in form of definite projects so efforts may be concentrated on the most essential problems. With the rapid development of the agricultural county farm bureaus the extension work in each county should be conducted in cooperation with the agricultural agents. In counties which have a pomologist, the work should be largely carried on by him under general supervision of the extension pomologist at the college."

Agricultural instruction in Prussia. E. VITAL (*Wiener Landw. Ztg.*, 68 (1915), Nos. 93, p. 688; 94, pp. 693, 694).—This is a review of the development and present status of agricultural instruction in Prussia.

Yearbook of the Department of Agriculture, Industries, and Commerce the Dutch East Indies, 1914 (*Jaarb. Dept. Landb. Nijv. en Handel Nederland Indië*, 1914, pp. VI+331, pls. 16).—This is a report of the Department of Agriculture, Industries, and Commerce, including its activities in promoting agricultural instruction and research in 1914, in the Dutch East Indies.

Preliminary suggestions for agriculture, domestic science, and manual training for elementary grades and high schools (*Des Moines: Dept. Pub. Instr.*, 1915, 2. ed., pp. 21).—This bulletin outlines the minimum requirements of the Iowa law as to the amount of agriculture, domestic science, and manual training that must be taught, the grades in which the subjects shall be offered, the teaching force needed, the preparation in these subjects required of teachers and the special rooms, apparatus, and equipment necessary.

Helps for teachers of agriculture, January-April (*Dept. Pub. Instr. Ind. Ed. Pubs.*, Bul. 12 (1915), pp. 30).—This portion of the bulletin outlines the second four months' work in soils and poultry, horticulture and dairying, and animal husbandry and farm crops, continuing previous work (E. S. R., p. 597).

Correspondence courses in agriculture for teachers. Course I, farm plants and soils (*Corresp. Courses Teachers [Iowa], Agr. Ext. Dept., Course I, Farm Plants and Soils, Assignm.*, 5, pp. 21, figs. 15; 6, pp. 23, figs. 8; 7, pp. 24, figs. 8, pp. 22, figs. 7; 9, pp. 23, figs. 4; 10, pp. 24, figs. 4; 11, pp. 24, figs. 8; 12, pp. 24, figs. 9; 13, pp. 24, figs. 9; 14, pp. 24, fig. 1; 15, pp. 23, figs. 14; 16, pp. 23, figs. 14; 17, pp. 23, figs. 14; 18, pp. 23, figs. 14; 19, pp. 23, figs. 14; 20, pp. 23, figs. 14; 21, pp. 23, figs. 14; 22, pp. 23, figs. 14; 23, pp. 23, figs. 14; 24, pp. 23, figs. 14; 25, pp. 23, figs. 14; 26, pp. 23, figs. 14; 27, pp. 23, figs. 14; 28, pp. 23, figs. 14; 29, pp. 23, figs. 14; 30, pp. 23, figs. 14; 31, pp. 23, figs. 14; 32, pp. 23, figs. 14; 33, pp. 23, figs. 14; 34, pp. 23, figs. 14; 35, pp. 23, figs. 14; 36, pp. 23, figs. 14; 37, pp. 23, figs. 14; 38, pp. 23, figs. 14; 39, pp. 23, figs. 14; 40, pp. 23, figs. 14; 41, pp. 23, figs. 14; 42, pp. 23, figs. 14; 43, pp. 23, figs. 14; 44, pp. 23, figs. 14; 45, pp. 23, figs. 14; 46, pp. 23, figs. 14; 47, pp. 23, figs. 14; 48, pp. 23, figs. 14; 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figs. 29; 17, pp. 18, fig. 1; 18, pp. 21, fig. 1).—These bulletins comprise lessons, prepared for the purpose of giving teachers in the rural and graded schools of Iowa a sufficient knowledge of agriculture to meet the requirements of the school law and of supplying outlines showing what to teach and how the material can best be presented. The lessons deal with the cultivation, history, distribution, improvement, varieties, etc., of the principal grain crops, the cultivation of potatoes, the home garden, fruit growing, trees on the farm, planning and planting the farmstead, legumes, forage crops, plant diseases and injurious and beneficial insects, weeds, fertilizers, and crop rotations.

Productive farm crops, E. G. MONTGOMERY (*Philadelphia and London: J. B. Lippincott Co.*, 1916, pp. XIX+501, pl. 1, figs. 265).—This book was written to meet the needs of students having some practical knowledge of crop production in agricultural short courses and secondary schools and of beginners in agricultural colleges. Because of its practical nature it may also be used as a handy reference book for farmers. The author has endeavored to develop the fundamental principles of crop production as demonstrated by practical experience, dealing with the classification, origin, distribution, growth, cultivation, insects and diseases, harvesting, and utilization of field crops in general as well as of individual crops. Practical exercises and review questions are included in each chapter. Data as to local weeds, market grades of hay and straw, and grades of grain are appended.

The small grains, M. A. CARLETON (*New York: The Macmillan Co.*, 1916, pp. XXXII+699, pl. 1, figs. 183).—This book is intended primarily for instruction in colleges and universities, but is also adapted for use in agricultural short courses, in academies and high schools, and by farmers and general readers. After a brief discussion of the fundamental principles of plant structure and nutrition, as related to cereals, the four principal cereals are treated separately and from the individual plant standpoint as to their origin, characteristics, classification, varieties, selection, and hybridization. Then, to avoid duplication, these cereals are treated together with reference to the further subjects of soil and climatic relations, acclimatization, cultivation, irrigation, weeds, insect and fungus pests, and uses. Buckwheat and rice, being botanically different from the four cereals referred to, are treated separately as to all topics. An extended bibliography is appended.

Corn and cotton, edited by C. A. McMURRY (*Peabody Col. Bul.*, 1 (1915), No. 3, pp. 48).—This pamphlet contains studies of the history, production, improvement, and uses of corn and cotton, the marketing and manufacture of the latter, competition in the manufacture of cotton goods, and references to literature on these subjects. The pamphlet is designed for the use of teachers and includes suggestions on methods, but is simple enough to be used by children as a text.

Weeds, I. G. ARMSTRONG (*Normal Teacher [Madison, S. Dak.]*, 5 (1915), No. 6, p. 31, figs. 151).—This is a suggestive outline for the use of teachers in the introduction of the study of weeds in rural and village schools.

Laboratory manual in general microbiology, W. GILTNER ET AL. (*New York: John Wiley and Sons*, 1916, pp. XVI+418, pl. 1, figs. 97).—This laboratory guide is based on the work of instructors at the Michigan College for over a decade and consists of three parts. The purpose of part 1 is primarily to give a working knowledge of laboratory methods used in the study of microorganisms, molds, yeasts, and bacteria being taken up in the order of their comparative size and studied as to their identification by morphological and cultural methods; part 2 consists of exercises demonstrating the various physiological activities of micro-organisms; and part 3 deals with applied microbiology. An appendix contains an outline for the study of microbiology, data on media, solutions, stains, etc., and a list of text and reference books.

Instructions for collecting and preserving valuable Lepidoptera for scientific purposes, J. SINCLAIR (*Los Angeles, Cal.: Author, 1916, pp. 80, figs. 61*).—The instructions, given in simple language and avoiding technical terms, are followed by cuts and descriptions of valuable butterflies and moths, as well as of a number of common ones which are very similar to them in appearance.

Poultry study for schools, J. W. HUNGATE (*Dept. Agr. State Normal School [Cheney, Wash.], Bul. A, No. 5 (1916), pp. 19, figs. 7*).—The author discusses the value of poultry study, poultry growing as a school project, teaching poultry raising to school children through clubs, poultry enemies, and the prevention of diseases, and outlines 12 exercises. A list of reference books is added.

Outlines in home economics, NEALE S. KNOWLES (*Dept. Pub. Instr. Iowa Circ. 4 (1915), pp. 95, pls. 8, figs. 3*).—The author outlines a half-year course, consisting of 90 lessons, in home economics for high schools. Five periods a week are to be devoted to the work, viz, two lecture periods and one sewing period of 45 minutes each, and at least two laboratory periods of 90 minutes each. Lists of individual and class equipment and references to literature are included.

Outline of domestic art work for the high school with bibliography MARTHA PATTERSON (*Ala. Girls Tech. Inst. Bul., n. ser., No. 31 (1915), pp. 34*).—These outlines in domestic art work are not intended as a course of study, but simply to furnish classified topics of fundamental work from which courses can be organized. Extended annotated bibliographies on domestic art and domestic science, the latter compiled by Louisa J. Keys, are included, together with list of illustrative material and its sources.

Home projects for agriculture and home economics, MRS. E. M. BARNER (*Texas Dept. Agr. Bul. 47 (1916), pp. 32*).—This bulletin contains programs, rules, and regulations for and contests in a number of home projects, rules of the home credit system, a constitution and by-laws for the junior farmers' institute, and a list of free bulletins to be used in home project work.

Course in school-home projects, 1916 (*Chicago: Co. Supt. Schools, 1916, pp. 15*).—This pamphlet gives general directions for school-home project work, and outlines courses in field and garden, business, cooking and sewing, poultry music, and cow testing school-home projects for the pupils over 10 years of age in the public schools of Cook County, Ill., all of whom now take a course in school-home projects as a part of their regular school work.

A first book of school gardening, A. LOGAN (*London: Macmillan and Co. Ltd., 1915, pp. VII+151, figs. 53*).—The aim of this book is to instruct pupils between the ages of 12 and 16 in the fundamental principles of soil management and plant growth and to provide practical instruction through the school garden. Review questions and practical exercises are added to each chapter.

School gardens (*Agr. Gaz. Canada, 3 (1916), No. 2, pp. 158-176, figs. 14*).—Brief reports are given on the progress of school and home garden work in the Provinces of Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

School fairs (*Agr. Gaz. Canada, 3 (1916), No. 1, pp. 77-83, figs. 3*).—This is a series of reports on the progress of the school-fair movement in the Provinces of Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

MISCELLANEOUS.

Twenty-sixth Annual Report of Arizona Station, 1915 (*Arizona Sta. Rpt. 1915, pp. 505-581, pl. 1, figs. 12*).—This contains the organization list, an administrative report by the director on the work and publications of the station.

financial statement for the fiscal year ended June 30, 1915, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue. A brief report on the work and expenditures of the college of agriculture is appended.

Report of Hawaii Station, 1915 (*Hawaii Sta. Rpt. 1915*, pp. 73, pls. 9).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the departments of horticulture, entomology, chemistry, and agronomy, the extension division, and the Glenwood substation. The experimental work recorded is for the most part abstracted elsewhere in this issue, as is also a special report of horticultural observations in Porto Rico, Cuba, and Florida.

Thirty-eighth Annual Report of North Carolina Station, 1915 (*North Carolina Sta. Rpt. 1915*, pp. 5-43+111, figs. 23).—This contains the organization list, a report of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1915, and reprints of Bulletins 228-231, previously noted.

Report of the Hood River, Oregon, Branch Experiment Station, 1915 (*Oregon Sta., Rpt. Hood River Sta., 1915*, pp. 61, pl. 1, figs. 14).—A report is given of the work of the year, the experimental features recorded being for the most part abstracted elsewhere in this issue.

Annual Report of Pennsylvania Station, 1914 (*Pennsylvania Sta. Rpt. 1914*, pp. 522, pls. 73).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1914, a report of the director on the work and publications of the station during the year, departmental reports, many special articles abstracted elsewhere in this issue, and reprints of Bulletins 128 and 133, previously noted.

Report of the director, 1915, H. L. RUSSELL (*Wisconsin Sta. Bul. 268 (1916)*, pp. 82, figs. 47).—This contains the organization list, a report of the work of the station during the year, portions of which are abstracted elsewhere in this issue, brief summaries of the publications of the year, and a financial statement for the federal funds for the fiscal year ended June 30, 1915.

Monthly Bulletin of the Ohio Agricultural Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916)*, Nos. 6, pp. 161-192, figs. 6; 7, pp. 193-224, figs. 11).—These numbers contain, in addition to several articles abstracted elsewhere in this issue, the following:

No. 6.—Variety r. Simple Rations for Laying Hens, by W. J. Buss, an extract from Bulletin 291 (*E. S. R.*, 35, p. 171); Potato Insurance, by D. C. Babcock; and The Mineral Requirements of the Milch Cow, by E. B. Forbes, an extract from Bulletin 295 (*E. S. R.*, 35, p. 481).

No. 7.—Variety Tests of Wheat, by C. G. Williams, an extract from Bulletin 288 (see p. 534); and Forage Crops for Swine, by W. L. Robison, adapted from Bulletins 242 and 268 (*E. S. R.*, 28, p. 468; 31, p. 868).

In memoriam: Eugene Woldemar Hilgard (*Berkeley, Cal.: Univ. Cal. Press. 1916*, pp. 50, pls. 2).—This includes the addresses at the memorial services held at the University of California, January 30, 1916; a reprint of an editorial from *Experiment Station Record* (*E. S. R.*, 34, p. 301); and a bibliography of Dr. Hilgard's publications.

NOTES.

Arizona University.—Stanley F. Morse, superintendent of the extension service, has resigned to become superintendent of a large commercial guayule plantation near Tucson.

Delaware College and Station.—M. L. Nichols has been appointed assistant professor of agronomy and assistant agronomist, vice W. A. Lintner whose resignation has been previously noted.

Georgia Station.—The building of two additional offices and laboratories to house the agronomist and assistant chemist has been authorized. The work is to be begun at once, as well as other improvements in the buildings and grounds.

Director R. J. H. DeLoach resigned November 1 to organize and direct a bureau of research and education connected with a commercial concern in Chicago. James D. Price, State Commissioner of Agriculture, has been appointed director beginning January 1, 1917. H. P. Stuckey will be acting director until that time.

Idaho University and Station.—Two new silos have been completed for testing new crops in feeding cattle and sheep, making five in use. In addition, 13 wood stave silos of $\frac{3}{4}$ ton capacity are to be devoted to a study of the fermentation processes of silage and of the use of crops other than corn.

Julius E. Nordby has been appointed instructor in animal husbandry and farm superintendent.

Illinois University and Station.—W. I. Brockson has been appointed assistant in crop production.

Purdue University and Station.—R. S. Stephenson has been appointed instructor in animal husbandry and W. B. Kruck and J. B. Markey assistants in animal husbandry in the college of agriculture, and George Cross assistant in animal husbandry in the station. Charles S. Brewster has been appointed instructor in poultry husbandry. P. S. Richey has succeeded P. E. Thompson, resigned, as assistant in animal husbandry.

Kentucky University and Station.—Dr. J. H. Kastle, dean of the college of agriculture and director of the station, died September 24 after a brief illness.

Dr. Kastle was born January 25, 1864, at Lexington, Ky., and was graduated from the Kentucky State College in 1881. He received the master's degree two years later from the same institution, and in 1888 that of Ph. D. from Johns Hopkins University. He then returned to Lexington as professor of chemistry, serving in this capacity for 17 years. In 1905 he became chief of the division of chemistry in the Hygienic Laboratory of the U. S. Public Health and Marine Hospital Service, and from 1909 to 1911 served as professor of chemistry in the University of Virginia.

Dr. Kastle was appointed research chemist in the Kentucky Station in 1911 and upon the death of Dean Scovell the following year succeeded him as dean and director. He was a member of the American Chemical Society, the Society of Biological Chemists, the American Physiological Society, and the Society of Chemical Industry, and the author of a long list of publications, mainly in biological and physiological chemistry. When taken sick he was preparing a paper on The Relations of the Experiment Station to Regulatory Work for

the November meeting of the Association of American Agricultural Colleges and Experiment Stations. He was a man of broad vision, marked originality, and clear thinking, and had rendered distinguished service in the fields of research, education, and administration.

George Roberts, head of the department of agronomy, has been appointed acting dean of the college of agriculture and Dr. A. M. Peter acting director of the station.

The department of home economics was separated in September from the college of agriculture as the college of home economics, with Mary E. Sweeny as dean. James Wright Wesson has been appointed assistant in agricultural economics and G. M. Roach inspector in the food and drug department, both appointments taking effect in September.

Missouri Station.—F. L. Bentley has resigned as assistant in animal husbandry to become instructor in animal husbandry at the Pennsylvania College, and has been succeeded by C. W. Sheppard, a 1916 graduate of the college of agriculture.

Nebraska University and Station.—H. E. Vasey, assistant professor of agricultural botany and assistant agricultural botanist, resigned September 1 to become instructor in botany at the Colorado College and assistant botanist in that station.

New Hampshire College.—J. M. Fuller, head of the dairy department of the Oklahoma College and Station, has been appointed professor of dairying, vice F. Rasmussen, resigned to accept a similar position at the Pennsylvania College. Miss Helen Knowlton, of Cornell University, has been appointed professor of home economics and dean of women.

Ohio State University and Station.—William R. Lazenby, associated with the university since 1881 and one of the pioneer educators in horticulture, died September 15, at the age of 66 years. Professor Lazenby was graduated from Cornell University in 1874 and served there as instructor in horticulture and botany until 1878, and as assistant professor until 1881. At Ohio he was professor of botany and horticulture until 1892, then professor of horticulture and forestry until 1909, and since that date professor of forestry.

Professor Lazenby was also one of the founders of the Ohio Station, serving as its first director from 1882 to 1886, and then as vice director until his removal to Wooster in 1888. He was a member of a large number of scientific organizations, among them the American Association for the Advancement of Science, of which he was a fellow and vice-president in 1896; the Society for the Promotion of Agricultural Science, of which he was secretary from 1886 to 1891 and president from 1895 to 1897; the American Forestry Association; and the American Pomological Society, of which he had been vice-president for several years.

Arthur Huisken has been appointed assistant in soils in the station.

Porto Rico Insular Station.—R. C. Rose has been appointed assistant pathologist beginning September 14.

Vermont University.—M. C. Wilson has resigned as farm management demonstrator of New Hampshire and Vermont to become state leader of county agents in New Hampshire. He has been succeeded by Walter G. Tubbs, a 1916 graduate of Cornell University, who will give his entire time to work in Vermont.

Virginia Truck Station.—J. T. Rosa, instructor in truck crops at the Iowa College, has been appointed assistant horticulturist beginning October 1.

Honduras Experimental Station.—A tract of land owned by the State on the Carretara del Sur, about five miles from Tegucigalpa, is being developed for

experimental purposes. The buildings are being remodeled and it is hoped eventually to maintain a complete experiment station and agricultural school. The work at present under way is largely of a preliminary nature with various crops.

Federal Agricultural Legislation.—In addition to the legislation already noted (E. S. R., 35, pp. 101, 200, and 301) a number of other provisions of agricultural and educational interest were adopted at the opening session of the Sixty-fourth Congress.

The act making appropriations for the support of the army establishes a council of National Defense consisting of the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. This council is to supervise and direct investigations and make recommendations, not only as to purely military measures but as to the increase of domestic production of articles and materials essential to the support of armies and of the people during an interruption of foreign commerce and similar matters. It is also to nominate to the President for his appointment an advisory commission of not more than seven persons, each of whom has special knowledge of some industry, public utility, or the development of some national resource. An appropriation of \$200,000 is provided for experimental work undertaken by the council, the advisory commission, or subordinate bodies, for carrying on the work provided.

A section in the National Defense Act of June 3, 1916, provides that soldiers in active service shall hereafter be given opportunity to receive instruction along vocational lines. Civilian teachers may be employed to aid the army officers in giving this instruction, which may include training in agriculture.

Under a provision in the Indian appropriation act, a farmer or expert farmer appointed in the Indian Service after January 1, 1917, and receiving at least \$50 per month, must procure certificates of competency showing that he is a farmer of actual experience and qualified to instruct others in the art of practical agriculture. These certificates are to be issued by the president or dean of the agricultural college of the State in which his services are to be rendered or by the corresponding official of the college in an adjoining State.

The Postmaster General is authorized in the appropriation act for the support of his Department to conduct experiments in three or more communities for the purpose of determining the most practical means of extending the operations of the parcel post in promoting the marketing of products and furthering direct transactions between producers and consumers. An appropriation of \$10,000 is made for this purpose.

A law which establishes standards for the so-called Climax baskets for grapes and other fruits and vegetables and for other types of baskets and containers used for small fruits, berries, and vegetables becomes effective November 1, 1917. Standards of 2, 4, and 12 quarts dry measure are provided for the Climax or "grape" baskets, while other containers are restricted in size to $\frac{1}{2}$ pint, 1 pint, 1 quart, and multiples of 1 quart dry measure. Penalties are prescribed for shipments in interstate commerce which do not conform to these requirements. The Secretary of Agriculture is to establish rules and regulations and to examine containers to determine their compliance with the act.

A standard "large barrel" of 250 pounds net and a "small barrel" of 150 pounds net are established for lime. All lime handled in interstate commerce in barrels must be packed in barrels of these sizes or a fractional part of the small barrel. Rules and regulations are to be prescribed by the Bureau of Standards and approved by the Secretary of Commerce. Penalties are provided for violations, beginning January 1, 1917.

Military Legislation Affecting the Land-grant Colleges.—Under the National Defense Act, the President is authorized to establish and maintain reserve officers' training corps at certain civil educational institutions. Universities and colleges requiring four years of collegiate study for a degree and at which instruction in military tactics is provided under the Morrill Act are grouped under what is known as the senior division of this corps, and each state institution may constitute one or more units of the corps if enrolling under military instruction at least 100 physically fit male students.

The Secretary of War is authorized to prescribe a course of theoretical and practical training for the units of the corps, this to include senior instruction and an average of at least three hours per week per year for the entire course. Provision is made whereby additional officers, noncommissioned officers, and enlisted men may be detailed from the regular army for service at these institutions, animals, arms, uniforms, equipment, and transportation may be supplied as needed, and field camps may be maintained.

Members of the corps who have completed two academic years of service and care to continue the course may be supplied by the United States with commutation of subsistence for the remainder of their course. Graduates up to a total of 50,000, who agree to serve at least ten years as reserve officers, may be so appointed, and any reserve officer thus appointed may be commissioned as a temporary second lieutenant of the regular army for not to exceed six months with pay of \$100 per month and the usual allowances. Graduates between 21 and 27 years of age who, prior to the passage of the act, have received the requisite training may also be appointed temporary second lieutenants and reserve officers.

Another law increases the number of cadets at the U. S. Military Academy. This law provides that 20 cadets are hereafter to be appointed by the President from the honor graduates of educational institutions having officers of the regular army detailed as professors of military science and tactics under the existing law.

A third act provides for the issue of Government supplies to these institutions for the establishment and maintenance of military instruction camps.

National Research Council.—Following a request from President Wilson, the National Academy of Sciences has organized a National Research Council. The purpose in view is stated to be to bring "into cooperation existing governmental, educational, industrial, and other research organizations, with the object of encouraging the investigation of natural phenomena, the increased use of scientific research in the development of American industries, the employment of scientific methods in strengthening the national defense, and such other applications of science as will promote the national security and welfare."

The membership is to include American investigators and engineers, representing the army and navy, the various scientific bureaus of the Departments and the Smithsonian Institution, educational institutions and research endowments, and the research divisions of industrial and manufacturing establishments. Dr. George E. Hale, director of the Mt. Wilson Solar Observatory, has been chosen chairman, and Dr. Raymond Pearl, of the Maine Experiment Station, a member of the executive committee. Committees have also been appointed on research in educational institutions, the promotion of industrial research, and a national census of research.

Agricultural Education and the European War.—According to a statement in the *London Times*, Mr. F. D. Acland, secretary of the British Board of Agriculture and Fisheries, recently stated in the House of Commons that the scheme of agricultural education had been retarded by the war, but that the popularity of agricultural education had undoubtedly increased and that

there had been real progress in the use made by farmers of the facilities offered. He "sincerely believed that no previous expenditure of money had helped us in this war more than that which had been spent in agricultural education."

Necrology.—Dr. Albert J. Cook, State Horticultural Commissioner of California since 1911, died September 29 at the age of 74 years. Dr. Cook was an early graduate of the Michigan Agricultural College, receiving the bachelor's degree in 1862 and the master's degree in 1864, as well as that of doctor of science in 1905. He also studied at Harvard University in 1867 and 1868.

Dr. Cook began his long career at the Michigan College in 1867 as instructor in mathematics. From 1868 to 1893 he was professor of zoology and entomology, as well as curator of the museum from 1875 to 1893 and entomologist in the Michigan Station from 1888 to 1901. He was professor of biology in Pomona College from 1893 to 1911. He had also been actively engaged in farmers' institute work in both Michigan and California and in the formation of organizations of citrus growers. He was an early experimenter with insecticides, notably kerosene emulsion in 1877 and the use of arsenites for the control of the codling moth in 1880, and the author of a number of works on bee keeping and other agricultural topics.

Prof. J. A. Portchinsky, the distinguished Russian entomologist died May 21 at the age of 68 years. From 1874 to 1894, Professor Portchinsky was scientific secretary to the Russian Entomological Society, and since 1894 chief of the entomological bureau of the Ministry of Agriculture and chief editor of its memoirs. He was the author of 24 memoirs, besides a large number of other scientific contributions. He was also the Russian reviewer of the *Revier of Applied Entomology*. He had traveled extensively over Russia, Caucasias, and Turkestan, and collected a mass of materials on the biology of insects.

Foster E. L. Beal, assistant biologist of the U. S. Department of Agriculture from 1891 to 1901 and subsequently economic ornithologist of the Bureau of Biological Survey, died October 1 at the age of 76 years. Professor Beal was a native of Massachusetts and a graduate of the Massachusetts Institute of Technology in 1871. He had specialized in economic ornithology and was the author of numerous publications on the subject.

New Journals.—*Verslagen en Mededeelingen van de Directie van den Landbouw* is being published by the Department of Agriculture, Industry, and Commerce of the Netherlands. The initial number contains a history of the appropriations for agriculture in the Netherlands since 1798, an account of the Netherlands cattle trade with foreign countries, a report on agriculture in Great Britain and Ireland and their trade in agricultural products, and a list of the publications of the department from 1904 to 1915.

Boletim Fluminense de Agricultura e Industria is being published by the State of Rio de Janeiro, Brazil, as a means of bringing agricultural information more directly to the attention of farmers. The principal article in the initial number deals with millet.

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